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# SPECTROPHOTOMETRIC METHOD FOR ROUTINE CONTROL DETERMINATION OF COPPER 8-HYDROXYQUINOLINATE IN COTTON TEXTILES

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A Spectrophotometric method for the determination of 8-hydroxyquinolinium ion, as a measure of copper 8-hydroxyquinolinate in treated cotton textiles is presented.

The method is based on the solubility of copper 8-hydroxyquinolinate in dilute hydrochloric acid and the maximum absorbance of the solutions at 365 mμ. The method is offered as supplementary to the more standard procedures for determining copper 8-hydroxyquinolinate in textiles. Because of its simplicity, the author feels that the method should be useful for routine control purposes and in experimental textile processing with copper 8-hydroxyquinolinate where a great many routine determinations are to be made, providing the copper 8-hydroxyquinolinate, in a given case is entirely soluble in hot dilute hydrochloric acid and that other substances showing appreciable absorbance at 365 mμ are not present.

The influence on the method of several substances has been studied.

## INTRODUCTION

COPPER 8-hydroxyquinolinate is widely used for mildewproofing cotton and other cellulosic materials. Analytical methods for determining this compound in fabrics are important for control purposes and many excellent ones are available. For example, the colorimetric method for copper in textiles employing sodium diethyl dithiocarbamate (*1*), and polarographic and electrolytic methods (*2, 4*). These methods are somewhat tedious and often require prolonged digestions to destroy the cellulosic material prior to the actual determination of copper. The spectrophotometric method described below requires only simple extractions of the fabric with hot dilute hydrochloric acid and spectrophotometric measurements on the extracts at 365 mμ.

The method is based on the solubility of copper 8-hydroxyquinolinate in dilute hydrochloric acid and the maximum absorbance of 8-hydroxyquinolinium ion solutions at 365 mμ (*3*).

A calibration curve is prepared from dilute hydrochloric acid solutions of the copper 8-hydroxyquinolinate that is to be used in treating the fabric. It should be noted that commercial products may vary from 93 to 98% purity. The copper 8-hydroxyquinolinate and solubilized preparations used in the experiments described in this paper were the commercial products Cuproquins, made by Alrose Chemical Co, Providence, R I.

CALIBRATION——A Model B Beckman Spectrophotometer (equipped with an NTL 12216 filter) was used, the ultraviolet range of which is adequate for the required measurements at 365 mμ.

REAGENTS——The reagents used included commercial copper 8-hydroxyquinolinate (Cuproquin 97%) and dilute hydrochloric acid (200 ml C P concentrated hydrochloric acid made up to one liter with distilled water).

Three calibration test solutions were prepared, containing 20, 40 and 80 mg respectively of copper 8-hydroxyquinolinate in 500 ml dilute hydrochloric acid. Solubility was effected by hot digestion with portions of the dilute acid. After cooling, the volumes were made up to 500 ml with dilute hydrochloric acid. Spectrophotometric measurements made at 365 mμ in 1 cm cells showed respective absorbances of 1.5, .78 and .395 for the 80, 40, and 20 mg test solutions. (See Figure 1). Dilute hydrochloric acid was used as the blank.

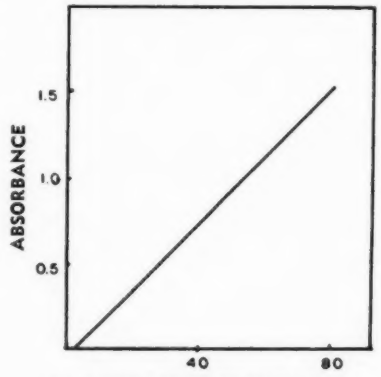


**Figure 1**

**Typical calibration curve for copper 8-hydroxyquinolinate concentration in 500 ml dilute hydrochloric acid. 365 mμ; 1 cm cells.**

## PROCEDURE

An accurate 5-gram sample of the treated fabric, cut into small pieces, is extracted three times (in a covered beaker) with 150 ml portions of hot dilute hydrochloric acid. Fifteen to twenty minutes for each extraction is usually adequate and during this time the contents of the beaker are moderately heated on a steam bath or hot plate. The total extracts at room temperature are made up to 500 ml in a volumetric flask, with dilute hydrochloric acid. A portion of the cool solution is filtered through No 42 Whatman filter paper, and spectrophotometric measurements made on this at 365 mμ in 1 cm cells, using dilute hydrochloric acid as a blank set at 0 absorbance.

## RESULTS

A bleached cotton fabric was treated with a solvent solution of copper 8-hydroxyquinolinate. Dry swatches of the treated fabric weighing 5 grams were extracted as described above. The solutions were made up to 500 ml in each case with

dilute hydrochloric acid. Absorbances at 365 mμ in 1 cm cells on the solutions from three sample swatches were .84, .86, and .87, indicating 46, 47 and 48 mg of copper 8-hydroxyquinolinate in 500 ml; .92%, .95% and .96% on the weight of the fabrics. (See Figure 1.)

For comparison, samples from the same lot of treated cotton were digested with potassium sulfate, nitric acid and sulfuric acid, in accordance with AATCC procedure for copper in textiles, and the copper subsequently determined colorimetrically with sodium diethyl dithiocarbamate (*1*). Results of the uncorrected determinations are shown in Table I. The results obtained spectrophotometrically are in good agreement with those obtained using the AATCC method when corrected for absorbance due to extractable from cotton itself (See Table III, g).

## DISCUSSION

Copper 8-hydroxyquinolinate in dilute hydrochloric acid solution is not appreciably adsorbed by No 42 Whatman filter paper. A clear solution of 0.080 g of a copper 8-hydroxyquinolinate in 500 ml dilute hydrochloric acid showed the same absorbance (optical density) of 1.5 both before and after filtration through No. 42 Whatman filter paper.

The copper 8-hydroxyquinolinate solutions have satisfactory stability as shown by the absorbances before and after standing overnight (Table II).

The method requires complete solubility of the copper 8-hydroxyquinolinate in dilute hydrochloric acid. This is usually achieved when the compound has been applied to a fabric from a simple aqueous or solvent solution. In other cases it may be necessary to extract for a longer period of time.

In some cases it may be advantageous to prepare a calibration curve based on spectrophotometric measurements on solutions obtained from dilute hydrochloric acid extraction of treated fabrics containing known amounts of copper 8-hydroxyquinolinate.

SOME INTERFERING AND NON-INTERFERING SUBSTANCES —— Substances other than copper 8-hydroxyquinolinate that would show appreciable absorbance at 365 mμ must not be present.

The absorbance of copper 8-hydroxyquinolinate at 365 mμ is due chiefly to the 8-hydroxyquinolinium ion (*3*). (See Table II; e, f, g.) Free 8-hydroxyquinoline, as well as its metal complexes other than copper that are soluble in dilute hydrochloric acid, would, if present, also absorb at 365 mμ (*3*); therefore the method is not applicable in the case of compounded products containing copper 8-hydroxyquinolinate plus other metal 8-hydroxy-

### TABLE I

### COMPARATIVE RESULTS OF COPPER 8-HYDROXYQUINOLINATE DETERMINATIONS ON A BLEACHED COTTON FABRIC CONTAINING COPPER 8-HYDROXYQUINOLINATE (APPLIED FROM A SOLVENT SOLUTION)

| *Analytical Method* | *Percentage on fabric weight* | |
|---|---|---|
| | *Copper* | *Copper 8-hydroxyquinolinate* |
| AATCC Method for copper in textiles (*1*) | {0.167 | 0.9243 |
| | {0.165 | 0.9120 |
| Spectrophotometric determination on dilute hydrochloric acid extractions | | {0.957 |
| | | {0.920 |
| | | {0.950 |

### TABLE II

### ABSORBANCES OF FILTERED DILUTE HYDROCHLORIC ACID SOLUTIONS OR EXTRACTIONS. (500 ML VOLUMES IN EACH CASE)

| *Solute or material extracted* | *Absorbance at 365 mμ in 1 cm cells* | |
|---|---|---|
| | *Cooled filtered solution* | *Solution filtered after standing overnight* |
| (a) 5.0 g bleached cotton fabric containing .92% copper-8-hydroxyquinolinate | .82 | .85 |
| (b) 5.0 g bleached cotton fabric containing .92% copper-8-hydroxyquinolinate and 8% copper naphthenate | .825 | .835 |
| (c) 5.0 g bleached cotton fabric containing 400 mg copper naphthenate | .065 | .03 |
| (d) 400 mg copper naphthenate | .055 | .00 |
| (e) 40 mg copper-8-hydroxyquinolinate | .73 | — |
| (f) 32.8 mg 8-hydroxyquinoline corresponding to the amount of this in (e) | .74 | — |
| (g) 7.2 mg copper corresponding to the amount of this in (e) | .05 | .04 |
| (h) 40 mg zinc chloride | .03 | — |
| (i) 250 mg aluminum chloride | .00 | — |
| (j) 250 mg nickelous acetate | .00 | — |

### TABLE III

### ABSORBANCE DUE TO CERTAIN DYESTUFFS, ETC (500 ML OF DILUTE HYDROCHLORIC ACID EXTRACT IN EACH CASE)

| *Material Extracted* | *Absorbance at 365 mμ in 1 cm cells* | |
|---|---|---|
| | *Cool filtered extract* | *Extract filtered after standing overnight* |
| (a) 5.0 g bleached cotton, pad dyed with 5% Ponsol Khaki 2G paste | .045<br>.065 | 0<br>.01 |
| (b) 5.0 g bleached cotton, pad dyed with 2% Ponsol Jade Green Double Paste (CI 1101) | .02<br>.05 | 0<br>After standing three hours before filtering 0 |
| (c) 5.0 g cotton fabric jig dyed with 10% Sulfanthrene Blue GR paste; 2% Sulfanthrene Blue G paste | .03 | .03 |
| (d) 5.0 g bleached cotton, pad dyed with 0.2% Diamine Fast Orange ER | .075 | .06 |
| (e) 5.0 g mineral dyed khaki cotton duck | 1.10 | — |
| (f) 5.0 g raw cotton (containing cotton waxes, etc) | .07 | .055 |
| (g) 5.0 g bleached cotton fabric | .015-.02 | .024 |

### TABLE IV

### SPECTROPHOTOMETRIC MEASUREMENTS AT 365 mμ IN 1 CM CELLS ON THE FILTERED DILUTE HYDROCHLORIC ACID SOLUTIONS OR EXTRACTIONS, WITH AND WITHOUT ADDITION OF SODIUM CHLORIDE BEFORE FILTERING. (500 ML DILUTE HYDROCHLORIC ACID SOLUTION IN EACH CASE)

| *Solution or extract* | *Transmittance* % | *Absorbance* |
|---|---|---|
| (a) 5.0 g cotton fabric containing .92% copper-8-hydroxyquinolinate | 15 | .82 |
| (b) 100 ml solution (a) plus 5 g sodium chloride | 15.5 | .808 |
| (c) .25 g of a commercial alkyl aryl sodium sulfonate | 90 | .045 |
| (d) 100 ml solution (c) plus 5.0 g sodium chloride | 102 | — |
| (e) .25 g of an alkyl aryl polyethylene glycol | 94.5 | .025 |

TABLE V

SPECTROPHOTOMETRIC DETERMINATION OF COPPER-8-HYDROXYQUINOLINATE IN COTTON DUCK TREATED WITH COPPER-8-HYDROXYQUINOLINATE AND WATER REPELLENTS. (DILUTE HYDROCHLORIC ACID EXTRACTIONS ON 5 GRAM SAMPLES OF COTTON DUCK AND 500 ML TOTAL VOLUME IN EACH CASE)

| | | Copper-8-hydroxyquinolinate | |
|---|---|---|---|
| | Absorbance* | Mg | % |
| Undyed cotton duck containing 1.25% copper-8-hydroxyquinolinate plus water repellants | 1.05<br>1.05 | 58 | 1.16 |
| Khaki vat dyed cotton duck containing 0.99% copper-8-hydroxyquinolinate plus water repellants | .93<br>.94 | 51 | 1.01 |
| Untreated khaki vat dyed cotton duck | .01<br>.015 | — | — |

* Measurements at 365 mμ in 1 cm cells.

quinolinates. In such cases the method would serve to determine total 8-hydroxyquinolinium.

Zinc, aluminum and nickel present in compounded products in some form other than as the 8-hydroxyquinolinates do not interfere. (See Table II; h, i, j.)

When working with known materials, one may correct for the absorbance due to the presence of other substances that show only slight interfering absorbance at 365 mμ. Dilute hydrochloric acid extractable material from raw cotton (containing cotton waxes, etc) shows some absorbance. (See Table III.)

The method is applicable in the presence of copper naphthenate as this compound is decomposed with the hot dilute hydrochloric acid. The insoluble naphthenic acid is removed by filtration when a portion of the extract is filtered for spectrophotometric measurement. In general, there is only slight absorbance due to the presence of copper naphthenate. (See Table II; a, b, c, d.)

The method is applicable in general to treated cotton fabrics dyed with dyestuffs that are fast to dilute hydrochloric acid extraction. The method is not applicable to treated textiles that have been dyed with "mineral khaki" (chromium and iron acetates) due to the high degree of ultraviolet absorbance shown by the ferric chloride in solution after the dilute hydrochloric acid treatment. (See Table III).

The influence of two types of emulsifying agents is shown in Table IV. An alkyl aryl sodium sulfonate type showed turbid filtrates. Addition of sodium chloride before filtration resulted in a clear filtrate. The insignificant influence of sodium chloride addition on the absorbance of dilute hydrochloric acid solutions of an alkyl aryl sodium sulfonate, and also on the copper 8-hydroxyquinolinate, also is shown in Table IV.

Table V shows the results of spectrophotometric determinations of percentage of copper 8-hydroxyquinolinate in undyed and dyed cotton duck containing known amounts of copper 8-hydroxyquinolinate plus water repellents.

## SUMMARY

A spectrophotometric method for the determination of copper 8-hydroxyquinolinate in treated cotton textiles has been presented. The influence on the method of certain dyestuffs, emulsiers, and of some interfering substances has been studied.

In general, the method would not be applicable to samples containing unknown substances; but it should be a useful supplementary method when working with known materials (whereby suitable corrections may be applied if necessary), provided the copper 8-hydroxyquinolinate in a given case is soluble in hot dilute hydrochloric acid and seriously interfering substances are not present.

## ACKNOWLEDGMENT

The writer is indebted to H Kroll for helpful advice in preparing the manuscript.

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*Seventh in a Series——*

# PROPOSED LABORATORY-ACCELERATED AGING TEST FOR CHLORINE RENTENTION IN TEXTILE FABRICS*

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This is the final in a series of reports on chlorine retention by textile finishes, sponsored by the American Viscose Corporation through a fellowship conducted at the Ellen H Richards Institute, School of Chemistry and Physics, The Pennsylvania State College, and currently at the Texas State College for Women.

## INTRODUCTION

THE use of resin finishes to stabilize the dimensions, as well as to impart other desirable properties to cotton and rayon fabrics, is a well-established practice. Some of these finishing agents, however, have the undesirable characteristic of retaining chlorine from sodium hypochlorite solutions in the laundry process, which causes loss in strength and yellowing of the white and light-colored areas of the fabric.

The purpose of this report is to present a tentative accelerated aging test, practical from a laboratory standpoint, which would permit the determination of the chlorine-retention property of resin-treated fabrics. The prediction with reasonable accuracy of the strength loss and yellowing found in fabrics treated with

* The investigation upon which this report is based was conducted in major part while Dr Mack was director and Dr Wham a research faculty member of the Ellen H Richards Institute, School of Chemistry and Physics, The Pennsylvania State College, and concluded after both joined the faculty of the Texas State College for Women.

TABLE I

COMPARISON OF RESULTS OF PROPOSED ACCELERATED CHLORINE TEST WITH PRACTICAL LAUNDERING AND LIGHT EXPOSURE TRIALS

| Fabric Number | Accelerated Test—Percentage Loss of Strength | Degree of Yellowing | Practical Trials: Nearest Corresponding Strength Loss (Number of Power Launderings With Low Chlorine Concentrations, With Pressing and Intermediate Light Exposure) | Practical Trials: Percentage Loss of Strength | Practical Trials: Degree of Yellowing |
|---|---|---|---|---|---|
| PART A. DRY, WARP BREAKING STRENGTH | | | | | |
| I | 39.0 | 2 | 10 launderings | 39.1 | 3 |
| II | 39.9 | 2 | 5 launderings | 39.2 | 2 |
| PART B. DRY, FILLING BREAKING STRENGTH | | | | | |
| I | 25.1 | 2 | 5 launderings | 14.6 | 3 |
| | | | 10 launderings | 31.4 | |
| II | 24.6 | 2 | 5 launderings | 21.7 | 2 |
| PART C. WET, WARP BREAKING STRENGTH | | | | | |
| I | 71.8 | 2 | 10 launderings | 66.5 | 3 |
| | | | 15 launderings | 83.8 | 3 |
| II | 78.1 | 2 | 10 launderings | 82.0 | 3 |
| PART D. WET, FILLING BREAKING STRENGTH | | | | | |
| I | 76.1 | 2 | 15 launderings | 73.5 | 3 |
| II | 51.3 | 2 | 10 launderings | 56.9 | 3 |
| PART E. DRY BURSTING STRENGTH | | | | | |
| I | 45.5 | 2 | 10 launderings | 40.0 | 3 |
| II | 39.7 | 2 | 5 launderings | 37.6 | 2 |
| PART F. WET BURSTING STRENGTH | | | | | |
| I | 73.4 | 2 | 5 launderings | 40.2 | 2 |
| | | | 10 launderings | 94.4 | 3 |
| II | 52.9 | 2 | 5 launderings | 47.1 | 2 |
| | | | 10 launderings | 67.0 | 3 |

chlorine-retentive finishes after a reasonable number of launderings constitutes the chief objective of those proposing the test.

Investigations by Wachter, Davison, and Knight *(1)*, by Wham *(2)*, by Wham and Lynn *(3)*, and by Wham and Mack *(4, 5, 6)* have compared the strength losses of resin-treated and nonresin-treated rayon fabrics when laundered under ordinary commercial conditions, involving a small concentration of chlorine bleach. These studies have shown that resin-finished fabrics suffer greater reductions in strength than do the nonresin-finished fabrics. Furthermore, they show that the magnitude of the loss is accentuated by intermittent exposure to light. Further investigations by Wham *(2)* and by Wham and Lynn *(3)* had to do with the treatment of urea-formaldehyde- and melamine-formaldehyde-finished fabrics, with varying concentrations of chlorine bleach followed by pressing at 400° F and 275° F, respectively, and exposure to graduated units of light in a standard Fade-Ometer. The results of these experiments indicated that, by dipping resin-treated fabrics in 0.13 percent of chlorine solutions, following with 40 hours of light exposure, and pressing at 275° F, the strength loss and extent of yellowing in the white areas of the fabrics can be made to approach that found in the same fabrics after five to 15 power launderings involving 0.01 percent chlorine concentrations, with pressing and intermediate light exposure. The comparative strength losses and extent of yellowing obtained under these two types of conditions, namely, the proposed accelerated test and the practical laundry-light trials, are shown in Table I. This proposed test, moreover, gives a distinct yellowing response (by virtue of the inclusion of pressing in the procedure) wherever this is likely to occur in practice.

## PROPOSED TEST

On the basis of the results of the studies cited above, the following method is proposed as a means of determining in the laboratory the strength deterioration and yellowing of rayon fabrics with chlorine-retentive finishes, which would be comparable to the strength loss and yellowing of these fabrics under conditions of actual use:

*Step 1*—Place fabric to be tested in distilled water containing 0.13 percent of available chlorine, raise temperature to 140° F and stir for 10 minutes.

*Step 2*—Rinse the fabric thoroughly five times by immersing for 30 seconds each time in distilled water with vigorous stirring; allow specimens to air dry.

*Step 3*—Expose the specimen for 40 hours in a standard FDAR type Fade-Ometer, remove and press with a hand iron for 80 seconds at 275° F, lifting the iron after each 10 seconds of contact.

## DISCUSSION

The test as recommended may be compared with the accelerated test used by Wachter, Davison, and Knight *(1)* as follows:

The concentration of sodium hypochlorite and the time of contact of the fabrics to the solution are the same in both cases.

In the earlier test, the samples are pressed dry after the chlorine treatment, whereas in the test as proposed herein, the samples are air dried.

In the former method, a standard pressing temperature of 400° F was used, whereas in the current proposal, 275° F is employed.

The earlier method did not include exposure to light in a Fade-Ometer, whereas this was included in the current test.

Results proved the earlier tests to be more severe than did the standard-power-laundry procedure including pressing and intermittent light exposure. The proposed method gives results which compare favorably with extensive practical trials.

## ACKNOWLEDGMENTS

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## Student Chapters

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# Research Newsletter

## NEWS IN GENERAL

AATCC is being looked to once again to help solve a knotty problem of testing. This time it's water repellency. The Industry Advisory Committee on Outerwear Water Repellent Fabrics, formed some years ago at the request of the Federal Trade Commission, has asked for AATCC help in setting up acceptable test methods for use in the proposed FTC trade practice rules on water repellency. ECR chairman, Leonard S Little, has formed two special committees for the purpose, one headed by Washfastness Committee Chairman Charles Sylvester, and the other by Albert E Johnson, Chairman of the Committee on Drycleaning Test Methods. Both committees are presently at work and reporting good progress. Recommendations will be made ultimately to FTC through the Industry Advisory Committee of which Charles Dorn is chairman.

Under preparation by a special committee is a new eight-page folder describing AATCC's Research Organization and activities to be released to Corporate Members and nonmember firms next September. This is being designed as an aid to members of corporate membership committees in the various sections.

## AT RESEARCH HEADQUARTERS

E P Johnstone, assigned to Committee on Drycleaning Test Methods, recently completed compilation of results of successive drycleaning runs made on 14 flock and metallic prints in six commercial plants. These will be used as a basis for correlating a brand-new test procedure of real promise utilizing metal containers with steel balls in the Launder-Ometer. The new test will be a welcome addition to the growing list of textile testing standards as no recognized procedure has been available up to now for the evaluation of the durability of overprints in dry cleaning.

Ed Johnstone has also been busy in AATCC's instrument shop building a "California Variable Angle Flammable Fabric Testing Rack" designed by Joe E Yockers, California State Fire Marshal. The instrument is capable of a broader range of flammability tests then in present equipment. The new device will figure importantly in forthcoming joint meetings of AATCC and fire protection groups.

Work is already underway at AATCC headquarters in connection with its research exhibit at the convention in Chicago, September 17-19. The growing size of these annual exhibits reflects the growing range of AATCC research accomplishments. But it means also an early start to get everything put together properly for an attractive, informative display.

Research Associate Charlie Seibert has found that better lightfastness research equipment, like better mousetraps, causes people "to beat a path to your door." At his home in Salem, N J, Charlie has some of the most advanced research equipment to be found anywhere for the study of Fade-Ometer operations and for the correlation of sunlight and daylight exposure with fadings in artificial light. Most of the members of the Lightfastness Committee have been out to Salem and Charlie has been host to several foreign research representatives. Charlie likes visitors and everyone is welcome.

## COMMITTEE ACTIVITIES

A new committee formed recently with George H Hotte as Chairman is hard at work on a study of all standard definitions that might be applicable to the needs of AATCC. Called the Committee on Definitions, it has asked all AATCC research committee chairmen to submit any terms that require clarification on

definition. The committee has been cooperating with a comparable group in the British Society of Dyers and Colorists. The standard definitions under review are those of Committee D-13 of the American Society for Testing Materials and of the Textile Institute of England.

Dr Sivert N Glarum, Manager of the Scientific Development in Ciba Company, Inc, was recently appointed Secretary of the Committee on Antistatic Finishes. His hobby is electronics, so we see why Ken is glad to have Doc take a prominent part in his antistatic project.

L Leslie Walmsley, American Viscose Corp, is filling the dual role of chairman and secretary of the Committee on Damage Caused by Retained Chlorine.

Dr A F Tesi of Celanese Corp is now assisting Doc Hawley as secretary of the Committee on Simplified Wet Control Tests.

E H Grosse, Dan River Mills, Inc, is the new chairman of the Committee on Evaluation of Desizing Agents.

A J Kellner, U S Testing Co, was recently appointed secretary of the Committee on Antimicrobial Agents.

## EMPLOYMENT REGISTER

***This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.***

53-12

*Education:* B S in Home Economics, with graduate work.
*Experience:* Textile Laboratory Technician.
*Age:* 23; woman; single; references; position near New York desired, laboratory or writing. 7-20, 8-3

53-14

*Education:* B S, Textile Chemistry and Dyeing.
*Experience:* Tricot and synthetics, dyeing and finishing.
*Age:* 33; married; position as superintendent of dyeing and finishing desired; Central or South America preferred. 7-6, 7-20

53-15

*Education:* High School, with extension courses in chemistry and business management.
*Experience:* Head Dyer, with experience particularly on synthetics.
*Age:* 42; married; references; position in South or Mid-West desired, as supt, head dyer or in technical sales. 7-6, 7-20

53-16

*Education:* M A, Chemistry; Statistics.
*Experience:* textile research chemist.
*Age:* 41; single references; position in research or sales service desired, detergents or textile processing. 7-20, 8-17

# CALENDAR

## AATCC

**COUNCIL**
Sept 17, Nov 20, Jan 22, Apr 30, June 15.

**NATIONAL CONVENTIONS**
September 17-19, 1953 (Hotel Conrad Hilton, Chicago); Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J).

**MID-WEST SECTION**
November 7, February 13 (Hotel Bismarck, Chicago, Ill.)

**NEW YORK SECTION**
Sept 25, Oct 23, Nov 20 (Swiss Chalet); Jan 29, Feb 26 (Hotel Statler, N Y); April 23, 1954, May 21, 1954 (Swiss Chalet).

**NORTHERN NEW ENGLAND SECTION**
Nov 6 (LTI); Dec 4 (MIT Faculty House).

**PHILADELPHIA SECTION**
Sept 11, Oct 23 (Penn-Sheraton Hotel, Philadelphia, Pa); Dec 4; Jan 15, 1954.

**PIEDMONT SECTION**
Sept 12 (Hotel Charlotte, Charlotte, N C).

**RHODE ISLAND SECTION**
Oct 23 (Prov Eng Soc); Dec 4 (Annual Meeting, Sheraton-Biltmore, Providence).

**SOUTH CENTRAL SECTION**
Aug 21-22 (Outing, Chattanooga Golf & Country Club, Chattanooga, Tenn); Dec 5 (Patten Hotel).

**WESTERN NEW ENGLAND SECTION**
Oct 2, Nov 6 and Dec 11 (Rapp's Restaurant, Shelton, Conn).

## OTHER EVENTS

**AMERICAN OIL CHEMISTS' SOCIETY**
27th Fall Meeting, November 2-4, Sherman Hotel, Chicago, Ill.

**AMERICAN SOCIETY FOR TESTING MATERIALS**
1953 Fall Meeting, Oct 14-16, New York, N Y.

**AMERICAN TEXTILE MACHINERY ASSOCIATION**
**Exhibit of American Textile Machinery, April** 26-May 1, Atlantic City Exhibition Hall, Atlantic City, N J.

**ASSOCIATION OF CONSULTING CHEMISTS AND CHEMICAL ENGINEERS, INC**
Annual Meeting—25th Anniversary-October 27 (Hotel Belmont Plaza, New York).

**GORDON RESEARCH CONFERENCES**
June 16-Sept 4 (Colby Jr College, New London, N H).

**INTERNATIONAL FEDERATION OF ASSOCIATIONS OF TEXTILE CHEMISTS AND COLORISTS**
1953 Congress: September 17-19, Luzern, Switzerland (under the auspices of the Swiss Association of Chemists-Colorists).

**INTERNATIONAL UNION OF LEATHER CHEMISTS SOCIETIES**
Barcelona Conference, Sept 13-18, Barcelona, Spain.

**NEW YORK BOARD OF TRADE (DCAT)**
**Drug, Chemical and Allied Trades Section;** 63rd Annual Meeting, Sept 24-27, Pocono Manor Inn, Pocono Manor, Pa; 28th Annual Dinner, March 4 (Waldorf-Astoria, New York, N Y).

**PHI PSI FRATERNITY**
51st Annual Convention, Feb 25-27 (The Carolina, Pinehurst, N C).

**SOUTHERN TEXTILE EXPOSITION**
October 4-9 (Textile Hall, Greenville, S C)

**TEXTILE RESEARCH INSTITUTE**
1953 Annual Meeting, Nov 12-13.

## "American Achievement Today Challenges Comparison"

# 1953 National Convention

### Sponsored by THE MID-WEST SECTION

*CONRAD HILTON HOTEL, CHICAGO, ILLINOIS—September 17, 18, 19*

## PRELIMINARY INVITATION

THE Mid-West Section is honored in being chosen the sponsor of the 1953 Convention and cordially invites you to be present. The complete Convention will be held in the Conrad Hilton Hotel in Chicago on September 17th, 18th and 19th. The Conrad Hilton, formerly known as the Stevens, is the largest hotel in the world and has guaranteed to provide sufficient accommodations for the entire Convention. This will be the first time in several years that all members and guests will be housed in the same hotel in which meetings and exhibitions are held.

Mid-September is probably the finest time of the year to visit Chicago. Thursday and Friday evenings are purposely left open because it is believed that Conventioneers will desire to avail themselves of the many opportunities for entertainment that Chicago offers.

## PROGRAM

Thursday, September 17th—
Morning : Council Meeting
Noon : Alumni Luncheon and Student Papers Contest
Afternoon: Technical Session—"Science Fibers"

Friday, September 18th—
Morning : Technical Sessions
A) Hosiery
B) Wool
Noon : Olney Medal Award Luncheon
Afternoon: Technical Sessions
C) Cotton
D) Auxiliaries

Saturday, September 19th—
Morning : Intersectional Contest
Evening : Annual Banquet

## TECHNICAL PROGRAM

The Technical Program will be outstanding with many fine papers to be given by men prominent in our industry. It is believed that subjects are highly interesting and sufficiently varied to attract a large attendance.

The American Institute of Laundering in Joliet, Illinois has invited members and guests to visit their plant on Wednesday, September 16th, the day prior to the Convention. Details will be given with the Final Notice.

## EXHIBITION

The entire Exhibition will be held in the large air-conditioned Exhibition Hall of the Conrad Hilton Hotel. The wide variety of exhibits will exemplify our slogan "AMERICAN ACHIEVEMENT TODAY CHALLENGES COMPARISON." Included in the exhibition will be displays by Dyestuff Manufacturers, Chemical and Resin Manufacturers, Machinery and Laboratory Equipment and also displays of new fibers and fabrics. Actual working models of dyeing and finishing equipment of the latest design will be shown.

## HOTEL RESERVATIONS

The Conrad Hilton Hotel with 3,000 rooms is undoubtedly the best equipped hotel in America for handling conventions, and has guaranteed ample accommodations for members and guests. Room reservations may be made ONLY through the Reservation Committee and an application card for rooms will be sent to you with the Final Announcement.

The Reservation Card must be returned with the Registration envelope.

The Reservation Committee will not reserve suites and members desiring suites should write direct to the hotel for a reservation, stating that it is required for the AATCC Convention. Many fine suites will be available overlooking Lake Michigan.

## PERSONNEL SERVICE

The usual personnel service will be operated during the Convention. If possible, members seeking employment should register before the Convention, but both members and employers may register at the Convention.

## LADIES' ENTERTAINMENT

A very interesting and varied program has been arranged for the Ladies attending the Convention and details will be given in the Final Announcement.

## ENTERTAINMENT

There is so much to see and do in Chicago that Thursday and Friday evenings and Saturday afternoon are left open for this purpose. An information booth will be in operation next to the Registration booth and full information will be available.

## TRANSPORTATION

Chicago, the transportation center of America, is easy of access from all parts of the country, by air, rail and road.

The principal Airlines and Railroads will be notified by the Transportation Committee to anticipate increases in reservations at the time of the Convention.

## FINAL NOTICE

A Final Notice will be sent to you and this will contain details on registration, hotel rates and reservations and also details on technical papers and ladies' program.

# DON McNEILL'S Breakfast Club

*WITH:*

FRAN ALLISON
PEGGY TAYLOR
CLIFF PETERSEN
EDDIE BALLANTINE
JOHNNY DESMOND
SAM COWLING

*on ABC Radio Network*
*Terrace Casino* *Morrison Hotel*

# LADIES!!

Would you like to be on the radio—and lunch at one of Chicago's most famous restaurants—where the stars go to hear Percy Haid, noted pianist?

This is your opportunity!

# Ladies' Program
# A.A.T.C.C. National Convention

CHICAGO, ILLINOIS • SEPTEMBER 17, 18, 19

**featuring**

*ALSO:*

A COCKTAIL PARTY — at the Conrad Hilton on Thursday afternoon from 4:00 to 6:00 P.M.

A TOUR — of the *Home Furnishing Section* at the famous *Merchandise Mart* after the Breakfast Club on Friday morning.

ADLER PLANETARIUM — on Saturday morning.

CONTINENTAL CUISINE
AIR CONDITIONED

*Citro's*

**Luncheon and Fashion Show**
**Friday at 12:30 P.M.**

ONE EIGHTY-ONE EAST LAKE SHORE DRIVE

THE AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS
LOWELL, MASSACHUSETTS

# *The Second Edition of the*
# COLOUR INDEX

Since the Second Edition of the Colour Index will be much more costly than the First Edition, owing to the great increase in size (from one to five volumes) and to the general rise in prices since the latter was first published (1924), the Association has prepared the following scheme of payments. The three annual payments (b) may prove convenient especially to individual purchasers; while the single payment (a) represents a considerable reduction on the final purchase price, and will help the Association both in financing the project and by giving an indication of the immediate demand for the work.

| | |
|---|---|
| (a) Single payment before September 1, 1953 | $85.00 |
| (b) Three annual payments | |
| 1) First payment before September 1, 1953 | 31.00 |
| 2) Second payment before June 30, 1954 | 31.00 |
| 3) Third payment on publication (1955) | 31.00 |
| | $93.00 |
| (c) Single payment on publication (1955) not less than | $99.00 |

Prices as quoted above include packing and postage to destination.

NOTES:

This payment scheme covers only the United States of America and non-British territories of Central and South America. For information on rates on payment applicable elsewhere please apply to the Society of Dyers and Colourists, 19 Piccadilly, Bradford, Yorkshire, England.

A 2½% discount will be allowed book dealers on fully paid Plan (a) Orders placed with The American Association of Textile Chemists and Colorists, Lowell, Massachusetts, before September 1, 1953.

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## ORDER FORM FOR THE SECOND EDITION OF THE COLOUR INDEX

**The American Association of Textile Chemists and Colorists, Lowell, Massachusetts**

**I wish to order ..... set(s) of the Colour Index (Second Edition) for which**

***a) I enclose single payment of $.....**

***b) I enclose a first payment of $ ....., and, agree to pay 2 further payments of $..... each before June 30, 195[illegible] and on publication (1955) respectively.**

**Name** .....  **Signed** .....

**Address** .....  **Date** .....

.....

.....

**Prices:**

**Plan (a) — $85.00 per set.**
**Plan (b) — Three equal installments of $31 each per set.**

***Please delete (a) or (b).**

**Please make checks payable to the American Association of Textile Chemists and Colorists.**

*Rhode Island Section*——

# NOVELTY PRINTING EFFECTS*

HERMAN P BAUMANN†

*American Aniline Products, Inc*

## INTRODUCTION

HAVING been on both sides of the fence, that is, both a practical mill chemist and a technical chemist servicing the plants for a dyestuff company, I can evaluate the advantages of each position. As the dyestuff-company employee is required to answer questions in all fields of dyestuff application, yarn and piece goods, paper and leather, and even on the influence of scouring, desizing, bleaching and finishing on his dyestuffs, he becomes versed in many directions, but he cannot claim to be an expert in any narrow specialty. The practical man, however, is acquainted with all the details of his particular field, and the quirks of his machinery, and becomes proficient in them. In his capacity as adviser, therefore, the dyestuff chemist is often asked to explain a process, a dyeing method or a printing procedure, and he can usually answer the query in a broad and general way, without, however, being able to supply the details which the plant chemist must work out.

It is in this manner, then, that I can give you general procedures for some of the printing effects I have been asked to explain.

*H P Baumann*

Several printing procedures not widely followed in the United States and yet very useful for special purposes are described. They include the printing of acid colors on rayon mordanted with "Katanol" O, the use of long-lasting acid-fading inhibitors in print pastes containing dispersible acetate dyes in acetate printing, the printing of metallic powders with various binders, blotch printing sheer nylon fabrics to simulate discharge printing, and the printing of phenol on nylon to obtain plissé effects. The advantages, especially to the screen printer, of the flash method for fixing anthraquinone vat dyes and the details of the procedure are also given. The last novelty printing effect described is one that is not uncommon in Europe, namely the use of printed resists under Indigosols applied in nip padding to obtain white and colored effects on a fast ground color.

## SPECIAL PRINTING PROCEDURES

KATANOL COLORS ON VISCOSE ——By Katanol colors are meant those acid dyes that are substantive on viscose which has been mordanted with tannin or tannin substitutes like Katanol, Thiotan, etc. We know that tannin is a mordant for basic colors on cellulosic fibers, and it is also a mordant for certain acid dyes, mostly of triphenylmethane structure. Katanol plays a similar role.

About five years ago there was a sudden vogue for brightly dyed viscose crepe, not so much for plain dye work as for prints. As the ground shades are not white dischargeable, they were generally overprinted in covered patterns with aniline black. The dyeings are produced on a Katanol mordant, which is applied in the dyebath like a true dyestuff, then topped with dyes like Patent Blue, Fast Acid Green and Brilliant Wool Blue, which are pleasantly bright, but of poor light fastness. The surprising point of this technique is that it is still popular and in demand in spite of the difficulty of the double operation and the poor all-around fastness of the dyeings.

What is not so well-known, however, is the reverse style—bright Katanol color prints on dyed backgrounds. I have often been asked to describe the method by which these prints were produced, and, having been their originator, I can give the details. The viscose is first dyed with a dischargeable color, such as Formaldehyde Black or Develop Blue BR (dev B-naphthol), and then printed. The print paste contains Hydrosulfite AWC (sodium sulfoxylateformaldehyde) plus Katanol O solution. To prevent precipitation of the Katanol, a little caustic soda is added along with it. No pigment or albumen is used. As example, the print formula might contain

| % | |
|---|---|
| 16 | Hydrosulfite AWC |
| 22 | water |
| 50 | gum |
| 8 | Katanol O solution |
| 4 | caustic soda, 40° Bé |
| 100 | |

After printing, the rayon is aged and immediately washed. The alkali in the printed goods demands a quick rinse for removal, otherwise the goods will rot. Since the goods will be dyed again, this rinsing may take place on the dye box.

Next, the material is dyed with a dyestuff that has affinity for the Katanol mordant but not for the rayon fiber. The following are suitable:

Alkali Fast Green 10G
Amacid Blue A
Brilliant Cyanine 6B
Amacid Milling Green B
Cloth Fast Yellow 2G
Chromorhodine BR

As these dyes have no affinity for the viscose, except where printed with Katanol, the dyed goods do not alter in shade. Even tans can be dyed and overdyed with blue. A two-tone discharge effect is made by a Katanol print of 8% strength alongside a 1/8% print.

PRINTING ACETATE DRAPERY MATERIAL——Printing acetate taffetas for ties and scarves is an art that has been perfected by both machine and screen printers. By choosing the brightest dyes of good dispersibility, printers have had success with the regular dispersed-type colors. Still, the blues and greys do not have any resistance to gas fading. Various chemicals and proprietary compounds have been recommended to put in the finish to inhibit this fading, but the simplest and most effective method of achieving this result is the addition of a permanent-type inhibitor directly into the print paste.

For printing drapery material, however, this method fails to include protection against light fading, especially in light blotches. For pale shades there are excellent anthraquinone acid dyes, especially blues, greens and greys, which will fix on acetate cloth if suitable swelling agents are added to the print paste. Swelling

* Presented in the hall of the Providence Engineering Society in Providence, R I, on Friday, January 23, 1953.

† A joint translator, with Paul Wengraf from German, of Diserens' books on *The Chemical Technology of Dyeing and Printing*, Reinhold Publishing Co (New York), 1948 and 1951.

agents include sulfocyanides, thiodiethylene glycol, and thiourea.

As example, a fast-to-light blotch print of a pale blue can be made on drapery cloth with

| % | |
|---|---|
| 0.2 | Alizarine Brilliant Blue R |
| 2.0 | Kromfax solvent |
| 44.0 | water |
| 50.0 | Keltex gum |
| 4.0 | ammonium sulfocyanide |
| 100.0 | |

METALLIC PRINTING —— Probably no other form of printing has occupied the attention of colorists for so many years, or through so many variations in technique, as metal-powder printing. We have records that Johannes Heinrich von Schuele painted gold and silver powders on fabrics in 1760. The earliest methods of fixing the metal powders were with glue, gelatin or albumen. Later, rosins and varnishes were used. Even as late as 1933, gum dammar and tung oil were being recommended for printing metallics.

However, these primitive methods have been replaced in the last twenty years by fixatives which permit much better flow on the machine and less sticking in the engravings. To review briefly the methods employed in the last score or more years, let us mention a few of them. There were animal glues, particularly gelatin or fish glue, with hexamethylenetetramine added to the print paste. To fix the glue the prints were sometimes steamed with formaldehyde vapors. Various water-insoluble pastes were employed, such as chlorinated rubbers, nitrocellulose lacquers, cellulose acetate lacquers and, later, polymeric resins of the vinyl type, dissolved in alcohol, toluene and aromatic esters. Phenol-formaldehyde thickenings of the "Bakelite" type were also tried. Next came urea-formaldehyde and melamine-formaldehyde precondensates, which, although water-miscible, lacked stability, and failed to fix the metallic powder satisfactorily. Cellulose xanthogenate, that is, viscose dope, has been tried as metal binder, as well as certain starchy derivatives.

But it is only with the introduction of the resin emulsions that print pastes possessing the advantages of water-miscibility, good binding action and lack of tarnishing action on the gold powder have been possible. Polyvinyl-acetate emulsions are quite stiff, and methacrylate-resin emulsions are thin and low in binding action.

Better results have been obtained with copolymers of butadiene and acrylonitrile, which are simply synthetic latices. Natural latex has been tried as pigment binder before but showed a tendency to peel off on calendering or ironing. The synthetic latices have many advantages: they are water-miscible, which means they can be printed alongside other dyestuff groups; they do not stick in the engravings; they do not tarnish the gold; and, lastly, they yield prints of excellent resistance to washing and dry cleaning. The prints must be cured or, at least, acid-aged to achieve maximum fixation.

Various formulations have been worked out by screen and machine printers, using different proprietary emulsions and latex preparations, either singly, or mixed together with melamine-formaldehyde or other precondensates in the print paste. In general, these latices are thick enough for printing, but, if not, they can be thickened with methyl cellulose, or carboxymethyl-cellulose gums.

About 1¾ to 2 lb bronze powder is used per gallon thickener. The binder is placed in a tub provided with a high-speed mixer, and the bronze powder is added with agitation. Prior wetting of the metallic powder is not necessary.

Some prints are here displayed illustrating the synthetic latex binder, some being machine, some screen printed.

NOVELTY PRINTS ON NYLON—— There is little novelty left to application printing on all nylon fabrics. Attempts to produce discharge prints on nylon sheers have not given entirely satisfactory results, but a partial solution to the problem has been offered by some colorists. The discharge effect is an illusion. The ground is blotch-printed, nylon being a thankful fabric in this respect. The style is gradually becoming popular.

There has been some printing on nylon-"Orlon" to leave the "Orlon" acrylic fiber white. With proper selection of dye and a good soaping after steaming, the results are generally quite agreeable. Some of the recommended dyes are

Amacid Neutral Yellow GNS
Fast Light Yellow 2G
Amacid Neutral Orange G
Amacid Milling Brown R
Amacid Fast Red BBL
Xylene Milling Blue 4B
Alizarine Brilliant Blue R
Alizarine Green CG Ex
Neolan Black WAN

Another pretty effect is dyeing cotton-nylon shantung to leave the nylon white, then discharging white. There are very few dyes suitable for this style, among them being

Amanil Fast Yellow RL
Amanil Brilliant Violet B
Amanil Fast Green BLC
Amanil Fast Blue FFB
Amanil Supra Rubine BBL
Amanil Develop Black OB

From these colors, however, a good range of maroons, browns, greens and black can be produced. White discharges and colored discharges with vat colors give handsome effects.

PLISSÉ PRINTING ON NYLON—— I have been asked to explain this process more often than any other, but this action is really more in the province of the plant colorist than of a dyestuff chemist.

The solubilizing action of phenol is the prime mover in the art, though other related products may also be used, such as cresylic acid or resorcin or mixtures thereof. The phenol, suitably thickened, is printed on, and the nylon is dried, then washed. In this action, so simply stated, the phenol partially dissolves the nylon, but is prevented from completely dissolving it by the protective action of the gum thickening; it does, however, shrink the nylon.

The mechanics of the process is a matter for each plant to solve as circumstances dictate. The pattern to use, the condition of the nylon——whether preset or not, white or dyed,——the depth of engraving, the temperature and mode of drying, and the quantity of phenol and gum are all matters which each successful printer feels are his own contributions and therefore not to be divulged.

However, some directive leads can be indicated here.

The nylon may be present or not, white or colored, providing the dyestuffs used stand the phenol overprint. Constructions vary from sheers to heavy taffetas, the quantity of phenol necessary to cause shrinking varying from 15% in the case of sheers, to 35% in the case of taffetas. As thickening agent, British gum can be used, or certain converted locust-bean preparations. Other gum thickenings can also be employed if the phenol is properly emulsified in it with a small amount of "Emulphor" or other surface-active agent. A gum which can be used in this wise is hydroxyethylcellulose ("Cellosize"). There are also "Aridye" Clears which have a tolerance for phenol. Heat promotes the action, so that it is advisable to dry at a high temperature. As tension interferes with uniform shrinkage, can drying is not recommended. A loop drier directly behind the print machine is the ideal set-up, with temperatures up to 325°F.

With proper equipment, deep engravings and high-temperature drying without tension, almost any pattern can be made to yield a permanent plissé. No particular aftertreatment is necessary, except a thorough rinsing.

There has been some successful printing of colors and metallic gold together with the plissé. For dyes, those having a tolerance for phenol and affinity for nylon can be printed along with the plissé print, and fixation is effectuated by the solubilizing action of the phenol, no steaming being necessary. Metallics require a different medium, probably "Aridye" emulsions.

FLASH METHOD FOR VAT COLORS ——This method, although neither new nor unusual, is mentioned here because it

is finding increasing favor among screen printers. Originally it was called the "Colloresine" method, and as such is about 25 years old. The name is derived from the thickening agent, "Colloresine," a cellulose ether, soluble in cold water but insoluble in hot water or in alkalis.

The vat-color pigment is thickened with the cellulose ether, or other suitable gum, such as Polymer gum, and some thiodiethylene glycol is added to the paste. After printing and drying, the cloth is padded with a solution of caustic soda and hydrosulfite. Addition of Glauber's salt is generally made to the padding liquor, also some Hydrosulfite AWC to bolster the reductive action. The cloth must pass immediately into the ager. An ideal arrangement is a two-roll padder directly under the entrance to the ager, the squeeze being horizontal to minimize smearing.

There has been very little change in the process as originally carried out, except in the length of the ager, which is now so short that only 30 seconds is required for passage of the goods and which is designed in such a manner that the face of the goods does not touch any roller.

It is claimed that there are five reasons for the popularity of this style:

1) The printed cloth does not have to be aged the same day, as the prints are stable in air.

2) Screen prints dry thoroughly on the table without detriment to color.

3) Print pastes are stable for a longer time.

4) The fastest anthraquinone vat dyes can be satisfactorily fixed, whereas the potash-hydrosulfite method of application has a serious limitation of fixable dyes.

5) The process is cheaper.

Let us examine these five claims: 1) The printed cloth can lay up. Actually, this is a condition but rarely encountered. No one wants, or can afford, a backlog of prints. For a screen print shop with a limited capacity, this property could be appreciated, or for a shop that does not have its own ager and must ship the prints outside for aging and washing.

2) The 2nd point, however, is valuable for screen printers, as the regular vat gum containing potash and hydrosulfite does not dry evenly, and during the long and hot drying necessary, some decomposition of the hydro always takes place.

3) The fact that print pastes are stable for a long time is also well taken.

4) The dyes which give the highest degree of light-fastness, the anthraquinone vat colors, can be brought out by the flash method. Thus the process has been chosen to print drapery and upholstery material where light fastness is most important. However, the style can be made to pay only if the designing is sufficiently interesting to attract the best markets. Further, it has been found that vat colors fix fully and brilliantly on silk fabrics, so that washable silks of bright and intricate patterns are attractively produced by this method.

5) The process is cheaper. It is necessary to point out that, although the anthraquinone vat colors are fixed better by the flash method, the indigoid vat colors are not. No advantage accrues to their yield or brightness on cotton drapery cloth over the regular print method.

INDIGOSOL RESISTS——Another specialty print process which might appeal to those doing fast-color work is the Indigosol-resist style. Either cotton or spun rayon lends itself to this style, which permits white and vat-color prints on a vat-dyed ground. There are various ways in which these results can be accomplished. The vat colors and white resist can be printed on white goods, and, after aging, the Indigosol color is padded on and developed with acid. Or the cloth is first impregnated with the Indigosol color and sodium nitrite, dried and overprinted with the vat colors. After aging, the development in acid is carried out.

The simpler method is to print on the white cloth. Here are some prints produced in this manner on spun rayon. After desizing and scouring, the cloth is printed as follows:

| | |
|---|---|
| *White* | 20 lb sodium thiosulfate<br>7 gals gum arabic paste<br>2 gals fish glue, 1:1 sol |
| | 10 gals total |
| *Vat Colors* | 1 gal vat dyestuff paste<br>9 gals potash-hydrosulfite gum |
| | 10 gals total |

The prints are dried and aged, then batched up for padding, which should be done immediately. Since the Indigosols are developed by acid oxidation, the presence of alkali as well as the residual hydro in the print paste resists their development.

The goods are padded at the nip, not dipped. This stipulation may require some special adjustments. The bottom roll of the mangle dips into the trough, but liquor is also fed across the top of the cloth to insure proper impregnation. To prevent pick-off of print pattern on the dry upper roller, the goods are fed in with the printed side down. The pad liquor consists of

| *grams per liter* | |
|---|---|
| 5-10 | Indigosol color |
| 10-15 | sodium nitrite |
| 10 | Tergitol #4 or #7 |
| 100 | gum tragacanth |

The cloth is developed through an acid tank connected in tandem with the mangle. A solution of 2% sulfuric acid is maintained at 120-140°F, through which the cloth passes, and here the padded color develops. A skying of 5 to 10 seconds is recommended after the acid bath, after which the goods are neutralized, washed and soaped well.

Most Indigosols are suitable for this style in light shades and give good white resists.

# Report of 21st Annual Outing—Mid-West Section

ONE HUNDRED AND FIFTY-THREE members and guests attended the 21st Annual Outing of the Mid-West Section at Lake Lawn Lodge, Delavan, Wisconsin on June 13, 1953.

In a morning feature, the salesmen again defeated the millmen in the annual softball game, 13 to 3. This was followed by a buffet luncheon, after which the golf and horseshoe tournaments were held.

Trophies and prizes, donated by mill and supplier friends of the Section, were presented after dinner by William Paine, Outing Chairman, and members of his committee. Winners of the golfing and horseshoe events were as follows:

## GOLF

*Low Gross (Guests):*
1st—E T Gurry and F Snyder, 77
2nd—F Andreae, 79

*Low Gross (Members:*
1st—R Anderson (winner of Millmen's Trophy), 78
2nd—A Rathke, 79
3rd—A Mitchell, 81
4th—G Willgeroth, 82

*Low Net (based on the Peoria System)*

Class A
1st—A Roy, 65
2nd—J Remson and C Kurowski, 66

Class B
1st—H Amasziez, 64
2nd—E Schroeder, 66
3rd—W Brainerd, 67

Class C
1st—W Paine, 59
2nd—A Coleman, 68
3rd—W Sites, 72

Class D
1st—J Brown, 65
2nd—G Chabot, 66
3rd—E Hazekamp, 66

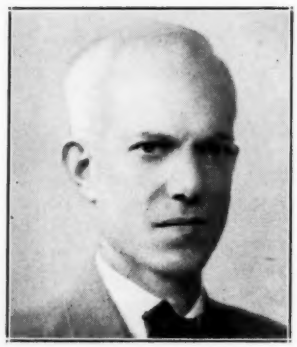
## HORSESHOES

*Singles*—B Isenogle
*Doubles*—H Thorpe and A Moskwinski

*Southeastern Section*——

# REVIEW OF MILDEWPROOFING TREATMENTS*

E C HANSEN AND CARL A BERGMAN
*General Dyestuff Corporation, New York*



*E C Hansen*

Great progress has been made in treating cellulosic textiles to protect them from decomposition by mildew—and also bacteria—under damp field conditions. The authors test the requirements of a good treatment for mildew resistance but point out that an idal treatment has not yet been developed.

Mildew-resisting chemical agents are of six types: inorganic, copper-organic, phenolic, mercuric, organic-sulfur and quaternary-ammonium. A seventh treatment is chemical modification of the cellulose, such as by acetylation. The chemical inhibiting agents may be applied by saturation with a solve..t solution, or saturation with an emulsion of a solvent solution. The last method has the advantages of not requiring special equipment and of not being hazardous with respect to fire.

*C A Bergman*

## INTRODUCTION

CELLULOSE decomposition is of major importance in nature's life cycle, including as it does the breaking down of carbon compounds to supply essential carbon dioxide to the atmosphere and humus to replenish the soil. Cellulose is decomposed in nature by a large variety of plant and microbial life, working alone or in cooperation for the purpose. Many of these processes have been utilized for the benefit of mankind through the formation of gases, alcohols and acids. Of growing importance is the utilization of these microorganisms in sewage and garbage disposal.

While this decomposition is essential to life, there is an enormous amount of damage caused by fungi and bacteria to materials man would like to preserve. Estimates of the damage in this country from deterioration run as high as twelve billion dollars annually with rot due to microorganisms accounting for a large part of the total.

The problem of preventing this damage received sporadic attention prior to World War II when the global nature of the conflict focused attention on the problem because of the rapid deterioration in the tropics of large quantities of clothing and other material necessary for the comfort and efficiency of our fighting forces stationed in tropical climates. Here the conditions were ideal for the rapid growth of molds and bacteria, and much damage resulted unless the materials were properly protected.

* Presented by C A Bergman in the Calloway Auditorium in La Grange, Georgia, on Sat, Dec 8, 1951.

REPRESENTATIVE CELLULOLYTIC MICROORGANISMS——According to Prof A J Salle in his book, *Fundamental Principles of Bateriology* (5), most of the organisms that are capable of fermenting cellulose are found in six recognized genera: Cellulmonas, Clostridium, Cellvibrio, Cellfalcicula, Cytophaga and Actinomyces. A considerable number of molds belonging to other genera also have been described as having the ability to utilize cellulose: Aspergillus, Penicillium, Trichoderma, Merulius, Paxillus and Polyporus.

Advantage is taken of the knowledge gained in the study of the cellulolytic microorganisms by selecting the most representative and controllable species for use in testing mildew resistance by accelerated innoculation tests. The most commonly used for this purpose are Aspergillus niger and Chaetomium globosum, but also included are Metarrhizium glutinosum, Penicillium glaucuma, Pheniphylicum sp and Trichoderma sp. However, experience indicates that no single innoculation test will satisfactorily show the relative efficiency of fungicides under all use conditions.

The soil is a rich source of fungi and bacteria. For example, one gram of soil contains between 10,000 and 200,000 spores and mycelium. These spores are carried everywhere with dust and all that is required to start mildew growth is favorable temperature, moisture and nutrient. Therefore, a soil-burial test is also frequently used for testing purposes.

DETERIORATION MECHANISM——It is known that the cellulolytic microorganisms form cellulose-dissolving enzymes, which break down the cellulose into more soluble forms that provide the nutrient for the organisms.

High humidity or other wet conditions are essential for mildew growth. If dry materials are stored in atmospheres of less than 35% relative humidity, there is practically no danger of deterioration due to fungi or bacteria, as witness the wrappings of mummies, which have survived for centuries because of desert dryness and absence of light. Use is being made of this knowledge in the moth balling of our fleets where dehumidification is a very important part of the process.

DETERIORATION PROTECTION——The ideal fungicide or chemical treatment for mildewproofing textiles should meet the following requirements:

1) Be nontoxic.
2) Be odorless.
3) Be colorless.
4) Be nonvolatile.
5) Have no undesirable action on textiles, dyes or finishes.
6) Be comparatively easy to apply.
7) Be durable.
8) Be readily available and moderate in application cost.

To the best of our knowledge, a product or chemical treatment has not yet been developed that will meet all of these requirements; however, we shall describe those that most nearly approach the ideal. Because many varied chemical compounds have been investigated for their mildewproofing power, we have grouped the more important ones under appropriate headings.

## ANTIMILDEW TREATMENTS

INORGANIC COMPOUNDS——Mildewproofing for special purposes had been practiced in a small way prior to World War II, with the salts of copper, chrome and zinc apparently being most generally applied for the purpose.

Copper is still one of the best fungicides but has an objectionable color and is toxic. However, large quantities have been and are being used for rotproofing Osnaburg sandbag material and cotton tentage.

Cuprammonium hydroxide in the Willesden Process has been used for lengthening the life of cotton filter cloths and nets. The process was developed three quarters of a century ago and consists of impregnating with a strongly ammoniacal cuprammonium solution and then dyeing at elevated temperatures to convert the soluble cuprammonium compound to a basic copper salt insoluble in water. The process has fallen into disuse because of the green color, harsh hand and loss of tensile strength; however, the process has been considered durable over these many years.

Cuprammonium carbonate and fluoride are less effective fungicides than the cuprammonium hydroxide and have the same drawbacks.

COPPER-ORGANIC COMPOUNDS ——Copper naphthenate is one of the best fungicides, it is considered durable, and large quantities applied from solvent solutions have been used for this purpose. It has an objectionable odor, strong green color and cannot be used for fabrics coming in contact with the skin because of toxicity. Effective use concentrations are 0.25 to 1% based on metallic copper. Zinc naphthenate has been substituted for copper naphthenate because it does not impart a green color to the fiber, being practically colorless. However, it is less effective as a fungicide and has the same objectionable odor. Copper oleate has been used for lengthening the life of rope, but is not so effective as copper naphthenate for this purpose.

Copper-8-quinolinolate is a comparatively new development, which is finding increasing use because of its efficient fungicidal property in the low concentrations of 0.1 to 0.2% based on metallic copper and because of its nontoxicity. It is practically insoluble in water and solvents and practically nonvolatile. The main drawback of this product has been application difficulties arising from its insolubility. The protection imparted is considered durable.

PHENOLIC COMPOUNDS——Examples of phenolic compounds are the tri-, tetra-, and pentachlorophenol, tetrabromo-orthocresol, 2-bromo-4-phenylphenol, para-nitrophenol, salicylanilide, 2,2′-dihydroxy-5,5′-dichlorodiphenylmethane (Preventol GD.) The sodium salts of chlorinated phenols are strongly fungicidal with the pentachlorophenol most active and widely used for this purpose at concentrations of one percent and over. As a result of solubility, they leach out with moisture and are therefore not durable. The same remarks hold true for the other monocyclic phenols listed here, and all of these compounds are more or less toxic in use concentrations.

Salicylanilide is a highly efficient fungicide, which has been used for many years, but which has the weakness of being nondurable. 2,2-dihydroxy-5,5-dichlorodiphenylmethane, which is a symmetrical condensation product of formaldehyde and a parachlorophenol, is a very effective mildewproofing compound in 0.5 to 1% concentrations with good fastness to leaching; it is considered semidurable.

MERCURIC COMPOUNDS —— The category of mercuric compounds includes phenyl mercuric acetate (Puratized PMA), lactate, triethanolamine lactate (Puratized N5-DS), oleate and linoleate (Puratized LN); also the pyridyl mercuric derivatives. These organic mercury compounds are good fungi growth inhibitors and have been used in volume for this purpose. They are fairly stable, practically colorless and odorless, but most have the drawback of being toxic and somewhat volatile at elevated temperatures. The concentrated products are highly toxic and should be handled cautiously.

Phenylmercuric acetate, lactate and phenylmercuric triethanolamine lactate are water-soluble compounds in varying degrees, and the first two products have attained considerable success as slime inhibitors in papermaking equipment. The phenylmercuric triethanolamine lactate has for many years been used for mildewproofing textiles because it becomes insoluble when dried above 160°F and therefore resists leaching. 0.02 to 0.04% based on metallic mercury gives satisfactory mildew protection and satisfactorily meets inoculation test requirements. The larger amount is used when severe leaching is part of the specification requirement.

Phenylmercuric oleate and phenylmercuric linoleate are soluble in solvents and are used primarily in coatings to inhibit mildew growth. Satisfactory protection is obtained with 0.02% calculated as metallic mercury.

Pyridylmercuric chloride, acetate and stearate show promise with good protection from 1% concentrations. They are toxic, however, and this will undoubtedly limit their usefulness for textiles.

ORGANIC SULFUR COMPOUNDS ——Most of mildew-proofing sulfur compounds are derivatives of 2-mercaptobenzothiazole or 5-chloro-2-mercaptobenzothiazole and dithiocarbamic acid. They are claimed to be very effective fungicides and bactericides, and they have the advtanges of being nontoxic, nonirritating and nonvolatile. They have not yet been tested sufficiently on textiles to be properly evaluated but have given interesting results for other uses. However, we understand a product comprising a mixture of salts of these compounds has tentatively been approved by the Quartermaster for use on certain fabrics. Another sulfur-containing compound, aminoguaiacalbenzothiazoleiminourea, has good fungi-inhibiting properties but is not fast to leaching.

QUATERNARY COMPOUNDS——Example of quaternary compounds are the trimethyloctadecylammonium pentachlorophenate, alkyldimethylammonium chloride and laurylpyridinium bromide. These "quats" are excellent bactericides and are commonly used for that purpose outside the textile industry. They have mildew-inhibiting properties also but are not so efficient or economical for this use on textiles as many of the compounds in the preceding groups.

CHEMICAL MODIFICATION——The toxic inhibitors mentioned above depend on the poisoning of organisms for their effectiveness. Chemical modification of cellulose to produce durable mildew-resistant finishes alters the chemical structure, making the modified cellulose indigestible to a microorganism. Such a finish has an additional advantage of being nontoxic, thus eliminating one of the most troublesome factors inherent in the use of toxic inhibitors for this purpose.

Considerable work on chemical modification has been done, but most of this represents laboratory experimentation. Apparently the greatest difficulty will be to adjust laboratory processes to plant procedure on available equipment.

Acetylation is the oldest chemical treatment to modify cellulose so as to impart a durable mildew-resistant finish. The early part of the twentieth century witnessed many efforts to modify cellulose chemically for the purpose of producing novel dyeing effects, and it was noted incidentally that acetylation also improved resistance to mildew damage. The process is difficult to control, though progress has been made in this direction. The cost of the process appears to be the main reason that it has not been more generally utilized for mildewproofing fabrics.

The nitrogen-phosphate flame-retarding treatments also impart a durable mildew-resistant finish. These finishes are usually produced with phosphoric acid and urea or guanidine under conditions that produce

a complex esterfication of the cellulose. One disadvantage of the treatment has been the reported lowering of tensile strength; however, we understand recent developments have improved this condition. Sensitivity to ultraviolet radiation has also been reported as a disadvantage.

The titanium-antimony finish imparts a very durable mildew resistance as well as flame-resistant properties. There is some debate on whether or not this finish actually combines chemically with the cellulose. This treatment does not lower the tensile strength of the fabric, according to information available to us.

The acrylonitrile treatment is being actively investigated at present to produce a durable mildew-resistant finish. The treatment produces a cyanoethylated surface and is carried out in the presence of caustic soda. It is claimed to increase tensile strength and to have the added advantage of conferring heat resistance to the treated fabric.

## APPLICATION METHODS OF TOXIC INHIBITORS

With the exception of the quaternary compounds, the toxic inhibitors we have mentioned are not substantive to cellulosic fibers. Because of this lack of substantivity, it is necessary to immerse the fabric or yarn in a solution of the fungicide to deposit the requisite quantity on the fiber. To accomplish this, three common systems are used: namely, aqueous, solvent, and emulsion systems.

AQUEOUS SYSTEM———Numerous commercially available fungicides can be applied from an aqueous system. Those that are inherently soluble in water merely require a simple padding and drying. Others require preliminary conversion to soluble salts, usually accomplished by dissolving in a caustic soda solution. In this case, a two-bath technique is used: application of the sodium salt of the fungicide to the fabric followed by a subsequent acid treatment to insolubilize the fungicide. Organic acids are preferable for this purpose.

Both of these systems lend themselves to use in conjunction with other water-soluble or dispersible compounds imparting water repellency and permanent finishing effects.

Advantages of the aqueous system are versatility, ease of application and lack of fire hazard.

SOLVENT SYSTEM———The inhibitor is dissolved in a suitable solvent, such as light petroleum or dry-cleaning fluids. The fabric is then padded through this solution and dried. The percent of fungicide deposited is controlled by the concentration of the solution and pickup of the pad. It is necessary to use enclosed equipment, which will permit recovery of the volatile solvents and reduce the fire hazard. The advantages claimed are good penetration and rapid processing. This is somewhat offset by the inherent fire hazard and the respiratory toxicity that can possibly develop from the solvents used.

EMULSION SYSTEM———The emulsion system of application is similar to the solvent system except an emulsion of an organic-solvent solution of the fungicide is applied to the fabric. The use of an emulsion eliminates the fire hazard, and conventional textile plant equipment can therefore be used. It is a relatively simple and inexpensive method of application. One drawback to this method is that the emulsifier deposited on the fabric diminshes the fastness of the fungicide. It is necessary to remove the solvent completely during the drying operation to prevent the fungicide from later crystallizing or blooming on the surface of the fabric.

## CONCLUSION

We have endeavored in the foregoing review of mildewproofing to cover in a general way the problem of microbial decompositions of cellulose and to highlight the treatments that have proved most effective for inhibiting or preventing mildew damage to fabrics.

Much progress toward the solution of this problem has been made, but the ideal mildewproofing treatment still remains to be found. The field is wide open for some group or individual through intelligent investigation to find the answer.

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# New York Section Outing Report

June 19, 1953

North Jersey Country Club, Wayne, N J

THE Annual Outing and Golf Tournament of the New York Section was held on Friday, June 19th, 1953 at the North Jersey Country Club, Wayne, N J.

The trophy for low gross, with a score of 74, was won by John Komninos of Waldrich Bleachery. Second low gross was turned in by Robert W Brewer of American Aniline Products, Inc with a score of 75 and third by Emil Grilli, Stein, Hall & Co, with a score of 77. Low gross for guests was won by Buddy Heydon, a student at Princeton, with a score of 73.

Low net honors were as follows: *1st*—G W Clendon, Pfister Chemical, 67; *2nd*—Ray Hamilton, Interchemical, 69; *tie for 3rd*—Edward C Jakob, General Dyestuff and Chris W Farrell, Bick & Co, 70.

In the kickers handicap, with a net score of 74, winners were: Dimitry G Zachary, American Cyanamid; Bert Manton, Plymouth Dye Works; William R Calabrese, Paulden Laboratories; Bob Hamilton, General Dyestuff; James V Cunningham, American Felt; J Harlow, Bellman Brook Bleachery; A Florio, Florio & Hauser; Harry G Kennedy, Warwick Chemical; Stephen J Luscian, American Cyanamid; G Sherman Monroe, Martin Weiner Corp; and Joe Stack.

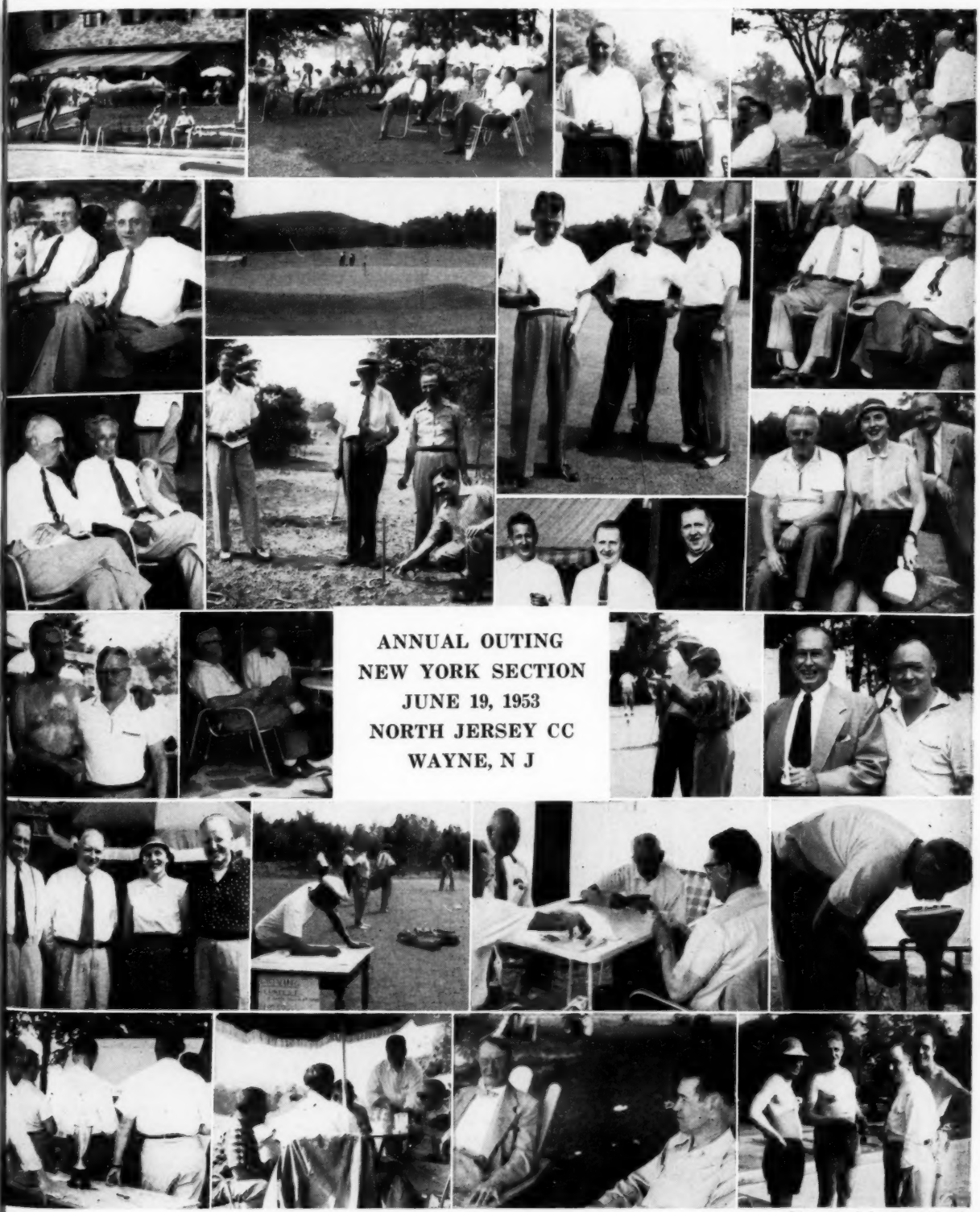
Nearest to the pin on the third hole was M Halprin, Seaboard Industries (9'11") followed by Frank Hall, Capitol Piece Dye Works (14').

Richard E Milana, American Aniline, was winner in the fat men's swimming race and in horseshoe pitching winners were Nick Stack, United Piece Dye, and Frank Habersberger, Kelco Co. In the printed sports shirt fashion plate award of Martin Weiner Co there was a tie between Ben J Hodes, Interchemical, and Nathan R Lufkin, Bellman Brook Bleachery.

Committee for the outing consisted of Chris W Farrel, Bick & Co, *Chairman;* Emil Grilli, Stein, Hall & Co, *Golf;* Robert F Holoch, National Aniline, *Horseshoes;* Richard P Monsaert, Jr, Puritan Dye Works, *Swimming;* Gerard Heine. American Aniline and Norman Farrell, Old Deerfield Fabrics, *Reception.*

The total attendance was 378.

Respectfully submitted,
NORMAN A JOHNSON
*Secretary*



**ANNUAL OUTING**
**NEW YORK SECTION**
**JUNE 19, 1953**
**NORTH JERSEY CC**
**WAYNE, N J**

*Photos by John J Sokolinski*

*Philadelphia Section* ——

# NEW DEVELOPMENTS IN THE DYEING OF "ORLON" ACRYLIC FIBER*

P L MEUNIER, J F LAUCIUS, J A BROOKS, and R J THOMAS
*E I du Pont de Nemours & Co, Inc*

## INTRODUCTION

AS MOST of you already know, the production of Type 41 "Orlon" acrylic staple was discontinued during March of this year. At the same time the Camden plant of the Textile Fibers Department started the manufacture of Type 42 "Orlon" staple. It should be noted that this change in types involves only the staple fiber. The production of Type 81 "Orlon" filament yarn is not affected in this development.

The principal difference between Type 41 and Type 42 "Orlon" staples is that of dyeability. Physical properties are essentially the same; but Type 42 has several advantages over Type 41 staple where dyeing properties are concerned. In addition to having improved affinity for acid dyes applied by the copper-ion method and considerably improved light fastness of the acid and acetate dyes, Type 42 exhibits a still more important improvement, which is dyeing uniformity. Compared with Type 41 "Orlon," the affinity of the new type for dyes is considerably less affected by heat treatments prior to dyeing. This means that there should be much less difficulty with warp streaks when yarns are slashed, and fabrics should be less likely to show spottiness when subjected to nonuniform steaming or heating of any kind prior to dyeing.

This superiority of Type 42 will have much greater merit for dyeing piece goods than for rawstock or top. It remains to be seen whether the degree of improvement exhibited by Type 42 will result in much better uniformity in package-yarn dyeing. Thus far it does appear that the dispersed acetate-type dyes will find much more use on Type 42 than on Type 41 "Orlon" because of their greatly improved light fastness, and, for this reason, yarns and piece goods will be dyed levelly at least in the light shades. The dispersed dyes level very well on Type 42 "Orlon" acrylic staple because of their recognized ability to "boil on and off," or transfer.

Table I lists the advantages of Type 42 "Orlon" in comparison with Type 41.

* Presented by P L Meunier at the Hotel Du Pont, Wilmington, Del, on Friday, April 17, 1953.

*P L Meunier*

It is claimed by the authors that the new Type 42 "Orlon" acrylic staple fiber has essentially the same desirable physical properties as the recently discontinued Type 41 staple and that, in addition, it has greatly improved dyeing properties. Not only does the new type of dyeable "Orlon" have greater affinity for acid dyes applied by the copper-ion method and greater fastness to light for both acid and acetate dyestuffs, but it has the important advantage of more uniform affinity because that affinity is less affected by heat treatments prior to dyeing.

Most of this paper reviews five important dyeing processes for "Orlon" staple, including the copper-ion method for acid dyes, the dyeing of acetate dyes, the dyeing of basic dyes, piece dyeing, and the dyeing of blends of staple "Orlon" 42 with wool and rayon.

We have already discussed certain aspects of some of these advantages. The others will be covered during our closer examination of the dyeing properties of the new type of "Orlon" staple.

TABLE I

ADVANTAGES OF TYPE 42 VERSUS TYPE 41 "ORLON" ACRYLIC STAPLE

1) Very little change in dyeabiliy on heating, better uniformity.
2) More dyeable at lower temperatures with acid dyes.
3) Better light fastness with acid dyes.
4) Wider range of acid dyes applicable at 212°F.
5) Brighter shades with acid dyes without carriers.
6) Much better light fastness with dispersed dyes.
7) Easier removal of tints.

## DYEING METHODS FOR TYPE 42 "ORLON"

Fundamentally, the dyeing processes for Type 42 are the same as for Type 41 "Orlon." We will now consider them as follows:

I—The application of acid dyes by the copper-ion method, at atmospheric and superatmospheric pressures.
II—Dyeing with dispersed dyes
III—Dyeing with basic colors
IV—Piece dyeing of fabrics, and
V—The dyeing of blends of "Orlon" acrylic staple with wool and rayon.

### I APPLICATION of ACID DYES——

A. *Application of Acid Dyes by the Copper-Ion Method.* Type 42 "Orlon" acrylic staple dyes readily with acid dyes by the copper method. The rate of absorption of cuprous copper apparently is much greater at a given temperature on Type 42 than on Type 41, and the rate of absorption of dye is also very rapid. Many dyes which are applicable only at high temperatures on Type 41 can be applied at the boil on Type 42. This means that the range of dyes for Type 42 is considerably greater.

Hydroxylammonium sulfate, sodium bisulfite and glyoxal are still the preferred reducing agents for copper reduction. At the present time, the use of sodium bisulfite can be recommended only in closed circulating equipment (particularly if sulfuric acid is added to the bath) because of volatility of the resultant sulfur dioxide and the consequent loss of reducing power.

The higher rate of absorption of copper and dyes by Type 42 "Orlon" acrylic staple imposes some changes in the processes of dyeing, as compared with Type 41 "Orlon." First, in the case of dyeing piece goods at the boil, it is recommended that the dyeing be controlled by starting the reduction of copper at a lower temperature with stepwise additions of hydroxylammonium sulfate. If the absorption of copper and dye must be retarded further, sulfuric acid and a surface-active agent are added. The surface-active agent may be of the nonionic polyether type like "Emulphor" or "Triton" X-100 or of the sulfated type like

Compound #8, "Alkanol" WXN or "Avitex" AD.

While there is little experience to date on large-scale equipment, it is apparent that a more careful control of the dyeing procedure will be required. In using redox-potential measurements, high millivolt conditions should be employed since, under this system, the cuprous copper ion is absorbed at a slower rate.

Copper requirements for Type 42 "Orlon" are approximately the same as for Type 41. It is believed that dyeing assistants or carriers, such as phenol and orthophenylphenol, will find less use for applying heavy shades on Type 42 "Orlon" at the boil. For example, a laboratory dyeing with a combination of "Roracyl" Orange R, "Roracyl" Violet 2R and "Roracyl" Dark Green B yielded a black shade having good perspiration fastness without the use of such carriers. Also, the amount of copper required for this shade was about half that used for a similar dyeing on Type 41 "Orlon". However, confirmatory evidence of this sort on a mill scale has not yet been obtained.

Table II illustrates the comparative dyeing rates of acid dyes on Type 41 and Type 42 "Orlon" acrylic staple. At 212°F with 2.0% of dye, the per cent absorption of Du Pont Quinoline Yellow PN in 2½ minutes is four times greater on Type 42 than on Type 41 "Orlon." After ten minutes, the difference is considerably less, but still 60% greater. In one hour, the difference is only 7%. However, it is apparent that the rate is much greater during the initial stages of dyeing. Quantitative data on the rate of dyeing at lower temperatures indicate that the control of dyeing between 175 and 195°F is very important. It should be noted that the increased rate of absorption on Type 42 does not eliminate the problem of dye selectivity based on rate of dyeing. The Yellow PN is still a much slower dyeing color on Type 42 than either "Pontacyl" Fast Red AS or Du Pont Anthraquinone Blue SWF. Therefore, a careful selection of dyes on the basis of compatible dyeing rates must still be made.

Table III shows a comparison of light fastness of acid dyes on Type 42 and Type 41 "Orlon" acrylic staple. There is a surprising difference in light fastness in favor of Type 42 not only in the comparisons of self-colors but also in combination shades of navy, brown and red. Incidentally, these light tests were made in a Fade-Ometer which correlates very well with exposures in Florida sunlight under glass.

At this point we should repeat the fact that a much larger group of dyes is available for application on Type 42 "Orlon" at the boil than Type 41. There are many

**TABLE II**

**COMPARATIVE DYEING RATES OF TYPE 41 AND TYPE 42 "ORLON" ACRYLIC STAPLE**

| *2.0% Dye owf at 212°F* | *Time minutes* | *Per Cent Dye Absorbed* | |
|---|---|---|---|
| | | *Type 41* | *Type 42* |
| Du Pont Quinoline Yellow PN | 2½ | 7.5 | 30.0 |
| | 10 | 25.0 | 40.0 |
| Pontacyl Fast Red AS Extra Conc | 2½ | 25.0 | 40.0 |
| | 10 | 50.0 | 75.0 |
| Du Pont Anthraquinone Blue SWF Conc 150% | 2½ | 30.0 | 60.0 |
| | 10 | 45.0 | 80.0 |

**TABLE III**

**LIGHT FASTNESS OF ACID DYES ON TYPE 42 AND TYPE 41 "ORLON" ACRYLIC STAPLE**

| *Shade* | *Du Pont Quinoline Yellow PN* | *Pontacyl Fast Red AS* | *Du Pont Anthraquinone Blue SWF* | *Fade-Ometer Rating* | |
|---|---|---|---|---|---|
| | | | | *Type 42* | *Type 41* |
| brown | x | x | x | 5 | 3 |
| scarlet | x | x | — | 5 | 3 |
| blue | — | — | x | 6 | 5 |
| navy | x | x | x | 7 | 5 |

dyes which, at 1.0% strength, have a Fade-Ometer rating of 6 to 7, including the following:

Roracyl Orange R
Du Pont Neutral Brown BGL
Du Pont Crocein Scarlet N
Du Pont Anthraquinone Blue AB
Du Pont Anthraquinone Blue B
Du Pont Anthraquinone Blue BGA
Du Pont Anthraquinone Blue BN
Du Pont Anthraquinone Blue 2GA
Du Pont Anthraquinone Blue 3G
Du Pont Anthraquinone Blue 4GL
Du Pont Anthraquinone Blue RA
Du Pont Anthraquinone Blue RXO
Du Pont Anthraquinone Iris R
Du Pont Anthraquinone Rubine R
Du Pont Anthraquinone Violet RN
Du Pont Anthraquinone Violet 3RN
Roracyl Violet 2R
Du Pont Anthraquinone Green GN
Roracyl Dark Green B
Du Pont Neutral Gray L

In other words, the possibilities of good light fastness on Type 42 "Orlon" with acid dyes appear to be very good.

In addition to the prospects for good light fastness, the acid dyes on Type 42 "Orlon" have considerably better fastness to perspiration and staining in washing than the same dyes on Type 41 "Orlon."

The question might well be asked, "What are the chances of dyeing Type 42 "Orlon" at the boil with fastness properties equivalent to those obtainable at high temperatures under pressure?" The answer is that available information indicates pressure dyeing is required to obtain optimum fastness to cross-dyeing. Also, pressure dyeing still allows the use of the inexpensive dyes for building heavy shades of navy, dark brown and black at a considerable saving in cost of dye and reducing agents.

B) *Application of Acid Dyes in Circulating Machines.* The dyeing of Type 41 "Orlon" acrylic staple in circulating machines has been carried out successfully at 212 and 250°F. In the form of rawstock and top, this fiber has been used in both worsted and woolen fabrics for men's and women's wear. Consequently, much of our attention has been directed toward the development of procedures for dyeing Type 42 "Orlon" in circulating machines, especially in rawstock dyeing equipment.

Type 42 "Orlon" acrylic staple shrinks a little more and packs to a considerably greater extent than Type 41. Successful runs have been made on a mill scale at the boil but certain problems remain to be solved where dyeing at high temperature under pressure is concerned. The use of high temperature generally leads to better fastness properties on Type 42 "Orlon" than it did on Type 41. But the behavior of the new staple is such that unlevel stock dyeings result at high temperatures unless the rate of copper and dye absorption is slowed down. There is a greater tendency to pack and pull away from the sides of the machine, and this effect causes channeling. Hence, level application of copper and dye must be accomplished before this excessive shrinkage and packing effect takes place. We are happy to report that progress made along these lines of research has resulted in commercially acceptable dyeings in all but a few shades.

Level absorption of copper is obtained by the use of high redox-potential values, slower rise in temperature, dyeing at lower pH by addition of sulfuric acid, and use of sulfonated dyeing assistants such as Compound #8, "Avitex" AD, "Alkanol" WXN, and nonionic surfactants such as "Triton" X-100 and "Emulphor" 0. For the present, it is recommended that a dyeing temperature of 245°F, should not be exceeded. A typical procedure is as follows:

TABLE IV
REDUCING AGENTS FOR TYPE 42 "ORLON" ACRYLIC STAPLE

| | *Pounds Per Pound Cupric Sulfate Crystals* |
|---|---|
| hydroxylammonium sulfate | 0.4 - 0.5 |
| sodium bisulfite | 0.25 |
| sodium bisulfite—glyoxal mixture | 0.25 bisulfite<br>0.15 glyoxal (35%) |

1) Load "Orlon" acrylic staple.
2) At 120°F add dyeing assistant (0.25 to 1.0% on weight of fiber) and sulfuric acid (1.0%) if necessary.
3) Heat to 120-140°F. Add cupric sulfate.
4) Heat to 160°F. Add reducing agent, hydroxylammonium sulfate, sodium bisulfite, or a mixture of sodium bisulfite and glyoxal.
5) Add dissolved dyes.
6) Heat to 195°F at 2° per minute. Run 10-20 minutes.
7) Heat to 205°F. Run 15-20 minutes.
8) *Heat to 215°F. Run 15-20 minutes.
9) Heat to 225°F. Run 15-20 minutes.
10) **Heat to 235-245°F. Run 30 minutes.

* If a high-temperature dyeing.

** This step is not usually necessary.

Follow by scouring and addition of finishing agent as required.

The dyeing assistants promote levelness of dyeing, while the sulfuric acid will cause slower absorption of cuprous ion, which also assures levelness. However, the use of sulfuric acid decreases the solubility of some dyes and caution must be exercised in the selection of colors.

Table IV shows the quantities of reducing agents recommended for dyeing in circulating machines. The amounts given are based on one pound of cupric sulfate.

II DYEING WITH ACETATE OR DISPERSED DYES——The dispersed dyes on Type 42 "Orlon" acrylic staple have good fastness to light and washing. Their fastness to light is considerably superior to that on Type 41. Because they are capable of leveling by "boiling on and off," these types will probably be used extensively. Although they exhibited this property to some extent on Type 41, the improved uniformity of Type 42 will allow the use of these colors for knitting yarns, jersey, sweaters and woven piece goods of 100% "Orlon" and blends with other fibers.

At present the depth of shade obtainable with dispersed dye is limited. They do not build up or "pile on" as on the more hydrophilic fibers, such as nylon or acetate, and a lower order of tinctorial value is obtained. Dyeing assistants, such as the phenylphenols, help to build deep shades but they adversely affect light fastness. Consequently, it is expected that light shades will be dyed with the acetate dyes, but the heavier shades must be applied with basic or acid dyes.

At high temperatures under pressure, the acetate colors are absorbed at a faster rate to give medium to heavy shades, but the exhaustion efficiency is not great enough to avoid filtration in package yarn dyeing. This problem is being studied in an attempt to improve the rate of dyeing and build-up properties.

Table V illustrates the difference in Fade-Ometer fastness of dispersed dyes on Type 42 versus Type 41 "Orlon" acrylic staple. It is seen that the maize and baby-pink shades on Type 41 have 10-to-20-hour Fade-Ometer fastness, while the baby blue fades appreciably in the 5-to-10-hour period. These are examples of the best light fastness of dispersed dyes on Type 41 "Orlon" that we have observed. On the other hand, the same shades on Type 42 "Orlon" have excellent fastness, rating at least 40 to 80 hours. The following dyes were used in these shades on Type 42:

*maize* —0.15% Latyl Yellow YL
*baby pink*—0.05% Celanthrene Cerise B
*baby blue*—0.05% Celanthrene Brilliant Blue FFS Conc 200%

The dispersed dyes are applied in the usual manner with synthetic detergent, such as "Duponol" RA, or soap. Dyeings are carried out for one hour or more at the highest possible temperature, about 208 to 212°F, at atmospheric pressure or for one hour at raised temperatures under pressure.

III DYEING WITH BASIC COLORS ——Since Type 42 "Orlon" acrylic staple does not lose affinity for basic dyes as a result of heating prior to dyeing as did Type 41, these colors are attaining great promise for dyeing "Orlon" in many forms. Sometime ago we announced the new basic dye, Du Pont Basic Yellow OL, which has outstanding light fastness. Now a new red, Du Pont Basic Red 4G, is ready for trade evaluation, and this dye also has a relatively high degree of light fastness. When these colors are used with selected members of the established line of basic dyes, good fastness to light and washing on "Orlon" can be obtained.

The basic dyes are applied at the boil or at high temperatures under pressure with a small amount of acetic acid and sodium acetate. Some dyes on Type 42 "Orlon" exhibit an indicator effect in pressing, undergoing a color change, but the addition of 0.3% sodium acetate eliminates this effect. At the boil, basic dyes are absorbed on Type 42 "Orlon" acrylic staple at a slower rate than on Type 41 during the first half hour. During subsequent dyeing, however, Type 42 continues to take up dye at an acceptable rate, whereas Type 41 shows little additional build-up after the first hour. Medium shades can be obtained at the boil in a reasonable time. Under pressure, much deeper shades are made possible.

TABLE V
LIGHT FASTNESS OF DISPERSED DYES ON TYPE 42 AND TYPE 41 "ORLON" ACRYLIC STAPLE

| | *Fade-Ometer Hours* | |
|---|---|---|
| *Shades* | *Type 41* | *Type 42* |
| maize | 10 - 20 | 40 - 80 |
| baby pink | 10 - 20 | 40 - 80 |
| baby blue | 5 - 10 | 40 - 80 |

Among the uses for which the basic dyes appear to be well qualified for light to medium shades on Type 42 "Orlon" are the following:

hosiery, knit jersey and sweaters;
woven fbarics made of 100% "Orlon";
woven and knit fabrics made of blends of "Orlon" with wool, rayon, cotton or other fibers:
bright shades on "Orlon" stock for specialty yarns.

IV PIECE DYEING OF FABRICS——A. *Knit Goods Made of Type 42 "Orlon" acrylic staple.* In the short time that Type 42 "Orlon" has been available for mill-scale experiments designed to confirm laboratory results, the dyeing of half hose and cut-and-sew sweaters has been demonstrated with gratifying success. It appears certain that level dyeings having very good fastness properties can be made in paddle machines and rotary machines, resulting in garments possessing very desirable handle and loft.

In contrast to the case of Type 41 "Orlon," these garments made of Type 42 can be dyed in pastel shades with excellent light fastness and, where added brightness is desired, the new lightfast yellow and red basic dyes can be used either as self shades or in mixtures with the acetate types. Medium shades dyed with the basic colors will undoubtedly have adequate fastness, and only the heavy shades of dark navy and black, at present unobtainable with basic dyes, need be applied with acid colors.

These exhibits of knitwear made of Type 42 "Orlon" are striking examples of the good results that are being obtained. The baby pink was made with dispersed dyes and the lipstick red was dyed with basic colors. The half hose in tan, gray,

yellow, maroon and navy were also dyed with acetate and basic colors. All of these dyeings have good fastness to washing, perspiration and light.

Knit jersey fabrics of 100% Type 42 "Orlon" acrylic staple have also been dyed with acetate, basic and acid colors in reel machines. Color selection for this work will be similar to that practiced in deing sweaters and hosiery. The improved dyeing uniformity of Type 42 will make it possible to employ all three classes of dye to a greater extent than on Type 41. Heather effects on blends containing 15% of wool and 85% "Orlon" can be produced in the same manner as on fabrics containing Type 41 "Orlon" with selected chrome, CHROMACYL and acid colors on the wool component.

*B) Dyeing of Woven Fabrics.* Woven fabrics of 100% Type 42 "Orlon" acrylic staple for women's wear have been dyed levelly in light shades with acetate colors which give adequate fastness to light. For the light to medium shade range, we believe mixtures of acetate and basic dyes must be used to assure good coverage since only the acetate types level very well. Acid dyes applied with cuprous ion have not yet produced level dyeings on light-weight goods of plain weave. However, acid and basic colors both cover satisfactorily in the heavy shades.

Rope marking in beck dyeing is a problem as it was with Type 41 "Orlon." This is alleviated by applying 1.0% of "Avitex" R in the beck at 140°F for 15 minutes. After extraction the fabric is frame-dried at 270°F for 1¼ minutes, while being overfed 5% and pulled out 2.0 to 3% over the wet width. It is then heat-treated on the pin tenter at 325 to 350°F for 20 seconds with 5 to 8% overfeeding at about 4.0% under the dry width of the fabric. By this procedure, pronounced rope marks have been removed from light- and heavy-weight fabrics.

V DYEING OF BLENDS OF TYPE 42 "ORLON" WITH RAYON AND WOOL

——A) *"Orlon" Blended with Rayon or Cotton.* Acetate and direct dyes have been used to produce satisfactory dyeings in light shades by a one-bath method for simultaneous dyeing of the two components.

Although medium shades can also be applied this way, the dispersed yellow and orange dyes suitable as base colors for browns are deficient in either light fastness or sublimation. We have found that the new dyes Du Pont Basic Yellow OL and Du Pont Basic Red 4G not only reserve the rayon but they are compatible with the direct colors. Therefore, brown shades can be produced with mixtures of these particular basic dyes with the acetate and direct colors.

For union dyeing in deep shades, a two-bath procedure is indicated at the present time. The "Orlon" acrylic staple is dyed first with either acid colors by the copperion method or with selected basic and dispersed types. When the cuprous-ion method is used, a scour with sequestering agent such as "Versene" is given to remove copper from the rayon. The rayon is then dyed with direct colors selected on the basis of minimum staining on "Orlon."

B) *"Orlon" Blended With Wool.* The method for union dyeing blends of wool and Type 41 "Orlon" acrylic staple described in our Technical Conference last August is recommended also for blends with Type 42 "Orlon." The most serious obstacle to commercial dyeing of blends containing Type 41 was its sensitivity to heat prior to dyeing. When warp yarns were heated excessively, skittery dyeings resulted because of the difference in dyeability of warp versus filling yarns in the fabric. Type 42 "Orlon" does not exhibit this effect. As a result, much better dyeings have been obtained on the newer blends.

The union dyeing method consists of applying basic dyes to the "Orlon" and acid dyes to the wool in a one-bath procedure. Solid shades, tone-on-tone or contrasting effects can be obtained, also.

In principle, the process depends on the prevention of wool staining by the basic dyes. Dyeing is carried out at a full boil or 210°-212°F, with overhead steam on in the dye beck for one to two or more hours. It is advisable to boil even the light shades for one hour and the medium shades for two hours after exhaustion has taken place, since any basic dye on the wool gradually transfers to the "Orlon" in the presence of acid and nonionic aliphatic detergent, such as "Emulphor" ON or "Pluronic" F-68.

The new basic dyes being developed for "Orlon" acrylic staple dyeing have the desirable property of reserving wool. Du Pont Basic Yellow OL and Du Pont Basic Red 4G are available now for mill evaluation. A new blue will also be made available in the near future. These new types, supplemented by the best of the conventional line of basic dyes, such as Du Pont Rhodamine B, Du Pont Fuchsine Conc, and Du Pont Brilliant Green Crystals give a fairly good range of shades with light fastness at least adequate for women's wear.

In a kelly-green shade, applied to a blend of 55/45 Type 42 "Orlon"/wool, "Pontacyl" Light Green NV Extra and Du Pont Milling Yellow 5G Conc were used on the wool, while Du Pont Brilliant Green Crystals and Du Pont Basic Yellow OL were dyed on the "Orlon." After the material was run for a few minutes at 130°F in the Emulphor ON, sodium acetate, and acetic acid, the acid dyes were added and the temperature was raised to 160°F, whereupon the basic dyes were added. The temperature was raised to the boil and run one hour. The material was rinsed and dried.

The light fastness in this shade was limited by the acid green on the wool. There was a break in ten hours of Fade-Ometer exposure. A rust shade made with light-fast dyes for the wool and a mixture of Du Pont Basic Yellow OL, Basic Red 4G and Brilliant Green Crystals for the "Orlon", exhibited rather poor light fastness, going redder in ten hours. However, this fastness is improved to the 20-to-40-hour range by substituting the new experimental basic blue for most of the Brilliant Green.

In the union dyeing process, level-dyeing acid colors, neutral-dyeing acid colors and chrome colors are recommended for the wool component. Colors of the premetallized acid class should not be used at very low pH values with sulfuric acid because these conditions cause an undesirable shade change of some basic dyes. These colors have indicator properties on Type 42 "Orlon" during dyeing and in subsequent alkaline perspiration tests. The "Capracyl" dyes are recommended only for light shades since these types have a strong tendency to form precipitates with basic dyes.

## SUMMARY

We have given you a very preliminary picture of the dyeing properties of Type 42 "Orlon" acrylic staple in comparison with Type 41. Although the increased rate of dyeing with acid colors is resenting some problems in stock dyeing, we have already made a great deal of progress toward solving them. The improved dyeing uniformity of Type 42 "Orlon," coupled with the good light fastness of acetate and new basic colors, enables the dyer to process knitwear, hand knitting yarns and woven piece goods with a considerable degree of success.

For the dyeing of blends of Type 42 "Orlon" with wool, solid shades can be dyed with basic colors plus acid colors. For blends with rayon several new alternative methods have been added to those available for blends containing Type 41 "Orlon." Because of the improved light fastness of acetate dyes on Type 42 and the development of new basic colors, there is considerable interest in one-bath methods with these colors as such or with mixtures of dispersed and basic dyes along with direct colors for the rayon.

Research work is being continued on the various dyeing processes for Type 42 "Orlon" acrylic staple, and additional information will be published as it becomes available.

# Report of WNE Section Outing

NINETY members and guests attended the Sixth Annual Outing of the Western New England Section on June 19th at the Wallingford Country Club, Wallingford, Conn.

Following a full day of activities, Outing Chairman Carl Schilkowsky, Sydnev Blumenthal Co, presented Chairman R C Geering, Princeton Knitting Mills, who welcomed the guests. Mr Schilkowsky presented awards to winners of the various golfing events as follows:

*Low gross*
1st—A Gondyke 2nd—S Hoffman

*Low Net*
1st—W Greichem 2nd—J Dick

*Putting*
1st—A Bailey 2nd—M Marens

*B'ind Hole*
Low—F Kinch High—O Edelstein

*High Score*
A Goodwin

*Most Bogeys*
W Lowell

*Kickers*
N Glade, W Curtain, W Quigley, E Ferrante, A Rant, R Stenstrom, A Royle, R Broadhurst

*Pro's Kickers*
L Weisman, W Janson, A Rant, J Harley, M Greene

*Practice Putting*
1st—W McCann 2nd—A Tessier

Sixty-three companies contributed prizes to the Outing and were thanked for their generosity.

# ABSTRACTS

## Bleaching with Sodium Chlorite

A Bleachworks Manager, *Textile Mercury & Argus* 128, 347-9, February 20, 1953.

It appears to be generally realized that sodium chlorite offers a safe and easily controlled bleach for vegetable and regenerated cellulose fibers, provided corrosion problems can be overcome (this aspect of the problem is not discussed by the author).

The main reasons for the favorable consideration of sodium chlorite as a bleaching agent appear to be:—

1) no tendering effect on cellulose fibers with low fluidities and no oxycellulose formation is discernible;

2) temperatures up to boiling in the steaming process with chlorite-impregnated material can be used to produce good bleaching and absorbent materials without tendering when sodium chlorite is used alone at low pH values (e g, pH 3);

3) chlorite has a solubilizing effect on starchy sizes;

4) where chlorite alone is used, antichloring and souring are unnecessary, and simple cold water washing can be cut to the minimum; retention of traces of chlorite is generally said to be harmless in any subsequent coloring or finishing treatments;

5) continuous processing in either open width or rope state is practical;

6) where impregnation and steaming processes are used there are a) savings in chlorite, b) reduction of effluent problems, and c) minimum washing treatments;

7) better and more permanent whites than the traditional methods, using alkali boil and hypochlorite, are assured;

8) sodium chlorite is very suitable for a wide range of materials. For example, a mild chlorite bleach will give a very good and safe bleach for spun viscose rayons. With linen goods, which are apt to be overbleached with hypochlorite, the chlorite treatment will give a first-class white without any rise in the solubility number of the bleached material. In all cases equally good bleaching is said to result with a reduced amount of alkali boiling as compared with the hypochlorite bleach.

The author discusses the chemical reactions involved in bleaching with chlorite, and the influence of the three factors, pH, temperature, and concentration, all of which, he states, can be easily controlled. He also refers to the Mathieson patent (BP 608,547), which recommends padding the goods in a combination of chlorite and hypochlorite, followed by steaming. Various steaming devices are discussed.—WHC

## Nylon in Industry

J W Illingworth, *Textile Recorder* 70, 69-72, April, 1953.

Nylon has many outstanding physical properties, and despite its comparatively high cost it is finding an ever-increasing use in the industrial field. It is the custom to make two types of yarn—normal and high-tenacity nylon, the latter being made specifically for industrial purposes.

During World War II the entire output had to be devoted to the war effort and the use of nylon for civilian purposes ceased. Probably the most important of its military applications was for parachutes, where it served to replace silk. It was used also for such purposes as tow lines to pull gliders, climbing ropes for mountain troops, and shoe laces to resist deterioration in the tropics.

In the marine industry nylon has proved highly suitable for use in mooring and tow ropes, yacht rigging, and sail cloth. Other military uses have been for cord in aircraft tires and for rubberized pontoons and life rafts. Spun nylon has been used for jungle boot tops, for which purpose its resistance to flexing and abrasion and its immunity to tropical conditions make it ideal.

Various applications of nylon where high strength without undue weight is desirable include air mail bags, cargo nets, tarpaulins, and the mesh bags used in laundries. Nylon ribbons for typewriters are tough and durable. Nylon overalls are being used increasingly in industry, due to their long life.

Nylon has already established itself as a reinforcing agent for rubber, the high wet strength being a particularly valuable feature for a number of specialized applications. The adhesion to rubber of untreated nylon in continuous filament form is, however, poor, and there are only a limited number of uses, such as in proofed rainwear, where the material may be used without further treatment.

The author states that in the manufacture of rubber-coated nylon fabrics good adhesion is obtained by the addition of a polyisocyanate to the anchor coat. He also states that spun nylon has a greater adhesion to rubber than the filament yarn, but the tensile strength is somewhat lower.

The heat aging properties of nylon are not particularly good. After being heated for 42 days at 130° C, it retains only 14 percent of its original strength. Under similar conditions Terylene retains 86 percent and Orlon 71 percent, according to the author. Conversely, as the temperature drops, the strength of nylon increases; e g, at —50° C the increase is 34 percent.

Nylon tires have proved of great value because of their capacity for absorbing energy. In America, trucks operating 100 percent on paved highways have used nylon cord tires to advantage. They cost more than other tires, but many operators report a big saving on a cost-per-mile basis.—WHC

## The Prediction of Equilibrium Thermal Comfort from Physical Data on Fabrics

H B Hardy, J W Ballou and O C Wetmore, *Textile Research J* 23, 1-10, January, 1953.

The effect of clothing on thermal comfort depends mainly on three factors: the physical properties of the fabric, the air spaces between the body and the fabric, or between the fabrics themselves, and the characteristics of the environment, such as its effective radiative temperature and the temperature, velocity, and relative humidity of the air. All these factors are considered in the development of a theory that permits in principle the prediction of the equilibrium thermal comfort associated with any fabric under any specified set of conditions, on the basis of "thermal resistivities", which may be measured with laboratory apparatus. The step-by-step solution of a typical problem concerning the relative comfort ratings of several fabrics is presented as an example of the method.

*Thermal* comfort may be defined as "the absence of any unpleasant sensations of being too cool or too warm, or of having too much perspiration on the skin". This is a major factor in determining the degree of general comfort, and is one over which textile engineers have some control.

The present paper describes a method of using data obtained from laboratory equipment to predict the thermal comfort of any individual in thermal equilibrium with his environment, while wearing specified clothing under specified circumstances. The ultimate objective of this work is to provide quantitative relations between the commonly measured physical properties of fabrics and their effects on equilibrium thermal comfort. These may then be used as bases for the logical design of clothing for maximum comfort. (See also the following abstract).—WHC

## Fabric Evaluation Based on Physiological Measurements of Comfort

J H Andreen, J W Gibson and O C Wetmore, *Textile Research J* 23, 11-22, January, 1953.

In another paper (see previous abstract), different textile fabrics were compared as to their performance in resisting the flow of heat emanating from an electrically heated surface representing the skin. The insulation values of the fabrics were then related to the possible comfort afforded by each in the light of established physiological measurements of skin temperature and wettedness. Although these thermal effects contribute extensively to the "comfort" of an individual, complex physiological and psychological factors collectively play an important role in defining this abstruse quality with reference to clothing. A better understanding of the influence of clothing on the human factors which determine the degree of comfort is the principal objective of this research. A major part of this study has been concerned with an investigation of the physiological responses to various stimuli provided by different textile fabrics being worn by human subjects under controlled climatic conditions.

The physiological factors chosen for exploration as criteria of comfort were: average skin temperature, the degree of skin wetness as indicated by electrical conductivity at the body surface, the rate at which the subject perspires, how much he perspires (i e, the total sweat cost), the amount of perspiration picked up by the garment during the test, and the subject's body temperature and heart rate.

Test subjects exercised on a bicycle ergometer and a treadmill. The treadmill offers a customary, everyday form of exercise, and therefore is probably the more desirable machine for comfort studies.

Garments made from the following fabrics were tested: 1) 80/20 wool/Orlon acrylic fiber; 2) cotton shirting; 3) filament nylon shirting; 4) cotton denim; 5) spun nylon denim; 6) neoprene-coated nylon.

Thus far the experiments have indicated that comfort largely depends upon the geometry of fabric construction and the manner in which the fabric is worn on the body.—WHC

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## Acetate Rayon and Static

C W North, *British Rayon & Silk J* 29, 51-5, March, 1953.

During the many stages of processing cellulose acetate from the original yarn or fiber to the finished article, difficulties are sometimes encountered that are attributed to the generation and presence of static electricity. This will manifest itself in a variety of ways, depending upon many individual circumstances. For example, it can cause textile fibers to repel one another. It can at the same time cause textile fibers to attract dust particles or be attracted to metal objects in the vicinity, such as parts of machinery. It can also give persons working in the vicinity of the material a slight and harmless shock. In addition, there is the possibility of sparking, which may lead to a fire risk if inflammable vapors or finely divided dust or fly are in the vicinity.

The author explains the origin of static electricity, using as an illustration the charge produced when a rod of glass or ebonite is rubbed with silk. He explains that the charge produced on any one material under these conditions is dependent on the nature of the other material with which it has been in contact, and on the state of the two materials. In general, the less conductive material assumes a positive charge; a thread of acetate yarn passing over a guide made of metal (a good conductor) quickly becomes charged with positive electricity. On the other hand, a thread of acetate yarn passing over a porcelain or enamelled guide will become charged with negative electricity.

There is always a tendency for the charge acquired by a material to leak away, and this rate of leakage is governed by the state of the yarn and the condition of the surrounding atmosphere. If this rate is sufficiently high the static electricity will not build up and the troubles associated with it will not occur.

As an example of the effect which the surrounding atmosphere plays in the dissipation of electric charges, it is pointed out that a charge which at 90 percent relative humidity would take only one thousandth of a second to vanish, would take half a second at 70 percent r h and as much as 80 seconds at 50 percent r h.

There are several ways in which the static problem can be attacked. The author groups them under the following headings: grounding, control of humidity, treatment of the yarn, static eliminators, and radioactive isotopes. Each of these methods has certain advantages and generally some disadvantages.

Grounding of the machinery, or of the textile, will bring some improvement but is never 100 percent efficient.

High humidity will reduce static to a minimum, but introduces a rusting problem and may affect the health of the employees.

The treatment of the yarn is usually carried out either to modify the physical characteristics of the yarn so that it is less prone to generate static or to induce the static produced to leak rapidly away. Alternatively, a combination of the two types of modification can be applied. A lubricant, such a sulfonated oil, combined with a material that is a good conductor of electricity, may be utilized.

The author describes several types of "static eliminators" (so-called) that work by providing a path of ionized air, which allows the static to be conducted away from the yarn.

There is now available a wide range of radioactive isotopes, which can be used in the form of salts placed on metal strips for the discharge of static. The author comments, however, that radioactive eliminators are still in the experimental stage and not enough is yet known about their behavior in processing or their effect on personnel.—WHC

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## The Dyeing and Finishing Trades

A J Hall, *Textile Mercury & Argus Supplement*, March, 1953, p 95-7.

The author suggests that the past year has, more than any since the end of the last war, witnessed a large number of worthwhile discoveries and inventions.

He discusses the relative merits of wet and dry presetting of nylon, and refers to the recent discovery that the setting process can be beneficially influenced by the presence in the nylon of certain metal salts, notably zinc chloride, and also by certain organic substances, such as benzyl alcohol, preferably in the presence of sodium thiosulfate. In this connection he remarks that the presetting treatment can lower the tensile strength and abrasion resistance of nylon, and at the same time modify its receptiveness for dyes.

Recently it has been found that formaldehyde may act as protective agent for wool in several ways. For example, in stripping colored wool rags for the reuse of wool in spinning and other operations it is normally impossible to avoid a certain amount of fiber tendering caused by the stripping agent employed—a hydrosulfite compound. But now it is known that, if formaldehyde is present, this tendering can be completely avoided. Similarly, in the bleaching of wool with hydrogen peroxide under alkaline conditions, any attack on the wool by this oxidant can be reduced or prevented by first treating the wool with formaldehyde.

In these uses of formaldehyde it is believed that the formaldehyde becomes effective by forming cross linkages between the wool molecules. In raw wool the molecules are cross-linked to a considerable extent, but in the stripping, bleaching, and unshrinkable wool processes these cross linkages are broken, so that the molecules separate and become more vulnerable. Formaldehyde appears to form new linkages, thus correcting the damage done.

The author refers to a new process for

producing Aniline Black, using certain sulfamic acid derivatives of aminodiphenylamine, and to a simplified method of dyeing Mineral Khaki for army equipment. He briefly discusses recent progress in the use of continuous dyeing methods.

Turning to the synthetic fibers, he mentions the "somewhat surprising" use of copper as a mordant in dyeing such fibers as Orlon and dynel, and states that subsequent research has shown that the copper only functions effectively under certain specified conditions.

By dyeing the synthetic fibers under pressure at 120-125° C, he says, it is now practicable to produce deep shades and obtain improved fastness properties. For this type of dyeing to be carried out on a large scale new and special dyeing machines have been designed. At least three types are now available and are briefly described.

Discussing the use of resins in finishing, the author states that one disadvantage of applying urea-formaldehyde and other resins to viscose rayon fabrics to give dimensional stability is that formaldehyde vapors arise from the impregnating liquors and from the liquor-impregnated fabric; this is objectionable and can be injurious to the operatives. The same objection can be urged against the use of dimethylol formamide, made by reacting with formaldehyde with formamide; this product is very effective in conferring resistance to shrinkage. Recently it has been discovered that by using a special methylol formamide compound (made by reacting three moles of formaldehyde with two to six moles of formamide under alkaline conditions) all liberation of harmful formaldehyde vapors may be avoided.

The author points out that, when using methylated trimethylolmelamine condensation products to give dimensional stability to cotton and rayon fabrics, it is now better to have the condensation product present in the impreganting liquor in cationic acid colloidal solution, i e, with its particles positively charged. This preserves the strength of the fabric without loss of efficiency in the treatment.—WHC

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## Modern Detergency

F C Harwood, *J Textile Institute* 44, P105-13, March, 1953.

The author defines a detergent as "a substance which cleanses soiled surfaces when applied thereto in aqueous or non-aqueous solutions". He reviews the history of detergency from earliest times, and comments that soap was known in Pliny's time but was used as a pomade for the hair rather than as a detergent. By the 17th century it was being employed for washing household linens. The first synthetic detergent, Turkey-red oil, was introduced about 100 years ago. There was little further development until World War I, when, owing to the shortage of fats, the Germans introduced the alkylated naphthalene sulfonates, derived from nonfatty raw materials. Unlike soap these were unaffected by hard water. The search for other synthetic detergents continued, particularly during World War II, when there was a shortage of fats again, and today large amounts of such products are available.

Detergency is a very complicated process from a physico-chemical point of view, and although in practice the cleansing of a soiled fabric seems a relatively simple matter, satisfactory results are produced only if the detergent solutions possess a number of important properties, the lack of any one of which means that cleansing will be poor or even completely unsatisfactory.

A good detergent, the author says, must be capable of

a) wetting the surface which has to be cleansed,

b) displacing the soiling matter from that surface, and

c) emulsifying the removed soiling matter and holding it in suspension.

If redeposition occurs during any stage of the washing or rinsing process the result will be unacceptable.

To a considerable extent, the physical characteristics of the soiling matter and of the surface of the material to which this soiling matter adheres play a large part in determining the type of process which can most effectively be employed. In the case of a textile fabric, the ingrained dirt may reside inside the yarns, and some may even be absorbed in the capillaries in the fiber walls.

In order that the properties of detergents may be studied in the laboratory, standard soiled test cloths have been used in many laboratories, but in the author's opinion no universally satisfactory standard soiling matter has yet been found.

In practical detergency it is to be noted that relatively large agglomerations of greasy dirt have to be dispersed in a finely divided state. When these greasy agglomerates are first displaced from the solid surface that is being cleansed, relatively large pieces of "dirt" may be dispersed in the detergent medium. Subseqeunt dispersal into a finely divided state, i e, emulsification proper, requires both considerable force and a careful adjustment of the dispersion medium. The finely divided "dirt" must be "conditioned" so that its electrical and other boundary conditions are such that the tendency to re-adhere to the solid surface being cleansed is reduced to a minimum. In other words, the detergent solution must possess "good suspending power".

Discussing the types of detergents now on the commercial market and their main characteristics, the author points out that all detergents are surface-active compounds, but not all surface-active compounds are detergents. Modern detergents fall into three main classes of surface-active compounds, namely, anionic, cationic, and nonionic.

The anion-active compounds form the largest group, which includes soap; the sulfated secondary alcohols, which are manufactured from byproducts from the refining of petroleum; the alkylaryl sulfonates, some of which are also derived from petroleum and coal tar products; sulfonated hydrocarbon oils; and also sulfated fatty alcohols, which are derived from fatty materials.

Of the cationic agents, two are worth noting, not because of their detergent properties but because of a possible use in laundering as bactericides; these are cetyl trimethylammonium bromide and cetyl pyridinium bromide.

In the third group, nonionics, only one, a polyethylene condensation product, is produced commercially in England.

The author remarks that soap is a good all-round detergent but must be used in alkaline solution and is incompatible with hard water. Alkaline builders must be added to prevent hydrolysis during washing operations.

Those synthetics which are normally used commercially and in domestic washing powders are largely drawn from the sulfated secondary alcohol and alkylaryl sulfonate classes. Liquid detergents may be of these classes or of the nonionizing class — the polyethylene condensation product. They are excellent wetting agents, are usually stable in hard water and even in acid solutions. They are easily soluble in water and rinse out freely. They do not, however, possess good suspending power, i e, the ability to prevent redeposition, and on that account are not as good all-round detergents as the soaps. To overcome this deficiency, carboxymethyl-cellulose is added in small quantities to the detergent. Some of the washing powders on the market contain added CMC, particularly those which are alkaline through the incorporation of, say, a polyphosphate.

The role of foam in detergency is not yet fully understood. The synthetics, in general, do not produce heavy lathers, and the absence of a good lather is obviously somewhat disconcerting to an operator who is accustomed to using soap.—WHC

## Synthetic Fibers

(Papers presented at a Conference promoted by the Manchester Section of the Society of Dyers and Colourists)

*Textile Recorder* 71, 77-81, May, 1953.

### THE TEXTILE TRADE AND THE NEWER FIBERS
F H Clayton

The speaker pointed out that, as the world population increases and as the standard of living of backward nations is raised, more textiles will be required in future, particularly textiles that will last longer.

To be successful, he said a textile fiber must have the following merits in descending order of importance: 1) sufficient outstanding properties to ensure an adequate demand in at least one major consumer market; 2) the right price; and 3) a minimum number of shortcomings, e g, an extremely low melting point or a very low affinity for dyes.

### THE CHEMISTRY OF THE SYNTHETIC FIBERS
R J W Reynolds

The speaker outlined the basic principles of fiber formation and discussed amorphous and crystalline structures. High molecular weight, he said, together with linearity and symmetry in the molecule and the ability to undergo molecular orientation are essential requirements. He explained the chemical nature of the polyamide, polyester, and acrylic fibers, and those made from vinyl chloride and its modifications. He pointed out that it is still impossible to design a fiber with special properties or even to forecast in any real detail what properties may be expected from a polymer of given constitution; also, that it is difficult to improve a fiber in any one respect (e g, dye receptivity) without adversely affecting some of its other properties.

### THE DYEING OF "TERYLENE" FIBER
H R Hadfield

From a practical standpoint, the speaker said, only the disperse (acetate) and azoic dyes may be considered for the dyeing of Terylene. For the former class, a temperature of 100° C is essential, and even then, under normal dyeing conditions, only pale to medium shades are readily obtainable. This apparently poor affinity has been shown to be due to a very low rate of diffusion of the dye into the fiber. Actually, Terylene's capacity for absorbing disperse dyes is greater than that of nylon.

As for the azoic dyes, it has been found that certain fast color bases and 2:3 hydroxynapthoic acid are absorbed by Terylene in the same way as with the disperse dyes. The coupling of these two components is carried out in a hot nitrous acid solution. The Naphthols, he stated, cannot be used because they do not have the right molecular shape for ready absorption into the fiber.

The speaker also discussed the use of "carriers" in the dyebath. Of the large number of substances which have been examined for this purpose, only a few have been found of interest, he said. Among the most effective at low concentration are diphenyl and ortho- and para-hydroxy diphenyl. He recommended diphenyl for dyeing Terylene slubbing, half-hose, yarn in package form, or loose staple fiber, but said that ortho-phenylphenol is best suited for dyeing piece goods.

### THE PRINTING OF "TERYLENE"
A G H Michie

The speaker discussed the various dyestuffs suitable for printing on Terylene, and pointed out that the disperse dyes have a fastness to washing on this fiber superior to that on acetate or nylon, particularly when they are steamed under pressure, but that the fastness to light is not generally high.

Experiments on the use of vat dyes indicate that the alkaline leuco form has very little affinity for the fiber, and the most promising method of application is with the acid leuco compounds. Steaming at a pressure of 20-40 psi is necessary to obtain full shades with selected dyes. Oxidation of the dyes is most readily achieved with nitrous acid.

The speaker discussed another printing process, a modification of the pad-steam method, in which the printing paste contains only dye and dispersing agent, thickened with sodium alginate. He also discussed the proper selection of thickeners for both screen and roller printing.

### THE HEAT SETTING OF "TERYLENE" FIBERS
D N Marvin

The speaker stated that effective dimensional stability can be obtained on Terylene by heat setting at a temperature 30-40° C above that to which it will be subjected in service. The setting is accompanied by a harshening or stiffening of the fabric and this detracts from its draping qualities. Laboratory tests indicate, however, that the hand and crease recovery properties of fabrics set at temperatures up to 200° C can be restored by a mechanical treatment as simple as hand washing.

The speaker discussed the relative merits of pin tenters and cylinders for heat setting, and the use of hot air and radiant heat. He stated that fabrics may be heat set before scouring, between scouring and dyeing, or after dyeing. There are advantages, however, in setting at the earliest stage.

### THE "CUPROUS ION" DYEING METHOD
J S Ward

The speaker pointed out that this method was developed in the U S A as particularly suitable for dyeing Orlon. He stated that filament Orlon, dyed at the boil by the usual methods, is "virtually undyeable". Orlon staple has slightly better properties and will dye with disperse or basic dyes, but the fastness is only moderate. The cuprous ion technique, in which the staple fiber is pretreated with a cuprous salt and dyed with acid or direct dyes, produces dyeings of higher fastness with better exhaustion in a shorter time. He stated that the absorption of dye is controlled directly by the amount of copper on the fiber, which in turn depends on the concentration of copper in the treatment bath and the nature of the anions present. The monosulfonated acid dyes, generally speaking, are most successful for this process.

The technique of producing and applying the cuprous salt is described in considerable detail.

### THE DYEING OF NYLON YARN IN PACKAGE FORM
W S Willson

The speaker pointed out a number of advantages which cake dyeing of nylon possesses in comparison with cheese dyeing. Dyeing in cake form can be carried out with any of the usual classes of dyes used for nylon. There is no advantage, he said, in reversing the flow of liquor. By maintaining it from inside to outside the cake is kept in better condition. After dyeing it is best to finish off with a final bath containing an antistatic agent.

Acid and chrome dyes are used most extensively, depending on the end-use. Success depends on applying the dye slowly and gradually, the speaker said, and each dye has its own peculiarities and must be treated accordingly. The new range of metal complex dyes applied in a neutral bath have been shown to produce useful colors of good light fastness.

### PROBLEMS FACING THE DYER AND FINISHER OF SYNTHETIC FIBERS
J G Evans

If fibers or filaments are differentially stretched, uneven dyeings will result, the speaker stated. The lower the stretching, the greater the absorption of dye. Also, variation in the number of "sites" on which certain classes of dyes anchor themselves to the fiber will produce unevenness.

He complained about the indiscriminate use of "sightening" dyes, and stated that few dyestuffs are really suitable for use as fugitive tints, and if the fabric must be heat-set in the grey, the tinting dye may become permanently fixed. Grey creases also offer a problem.

In discussing dyeing problems, the speaker mentioned the difficulty in finding dyes of superior light fastness for nylon. The same is true of Terylene, ac-

centuated by the slow rate of dyeing and the fact that few dyes have affinity for the fiber.

He pointed out that these smooth, hydrophobic, nonswelling fibers respond indifferently to normal finishing operations. In particular, there is a demand for a good dulling agent and for a permanent antistatic agent.—WHC

### Rayon Fabrics for Rubber-Proofing

Anon, *Dyer* 109, 489, 491, April 3, 1953.

Rayon fabrics have been used for rubber-proofing or coating for over 20 years. Both acetate and viscose yarns are used in a wide range of constructions, including 100 percent viscose plain, twill, marocain and satin type fabrics; acetate-viscose shot-dyed and marocain fabrics; and acetate poult and taffeta fabrics. Excellent results are obtained and garments which are satisfactory in every way when used for rainwear are made from these fabrics. However, the dyer and finisher and the proofer must regulate their conditions of processing, otherwise an unsatisfactory appearance and proofing will be obtained.

The metal content of the fabric, in particular the amount of copper and manganese, and the fatty content should be kept to a minimum, while the pH of extract of the fabric should be as near neutral as possible.

Selection of dyes is extremely important. Apart from the usual requirements of adequate fastness to light under dry and wet conditions, to water, and to perspiration, the dyes must withstand the conditions of rubber-proofing. It is an advantage to know the proofer concerned and details of the methods he employs. Generally dyes must withstand other chemicals used in the treatment and possibly high temperatures.

Processes should be avoided which permit free copper to be present on the fabric. However, dyes that contain copper in the molecule complex should not give trouble. Acetate dyes should have the maximum fastness to gas fading.

The author also discusses briefly the proofing operation itself, and the necessary controls.—WHC

# • PATENT DIGEST •

## PAUL WENGRAF

### DYEING IN LIQUID METAL BATHS——
### Preheating the Fabrics C,1

Brit P 681,893
(Standfast Dyers and Printers Ltd—Nov 5, 1952)

This specification refers to the well-publicized dyeing process, which uses low-melting metal alloys for development. A series of related patents are discussed in *Am Dyestuff Reptr 41,* 306 and 442 (1952) —digests of British Patents 665,454 and 620,584.

It has been observed that irregular results may be expected with differences in temperature between the material to be dyed and the treating liquid that floats above the molten alloy. The temperature of the fabric may be low enough to partly solidify the liquid metal, which forms lumps at the interface between the goods and the dye liquor, causing spots and non-uniform dyeings.

It is claimed that this disadvantage is avoided by preheating the fabrics prior to their entry into the metal bath. If the textile is to pass through the dyebath on the surface—as described in the prior art —the combined temperature of the material and the dyebath should be above the freezing point of the alloy. The same is true when the material is padded with dye liquid before entering the apparatus, and there is no dye liquid floating on the metal. The upper limit should be about 100°C to avoid the formation of steam bubbles. In the case where a padded and dried material is developed in the metal bath, the upper limit may be as high as it is compatible with the resistance of the fibers to deterioration (about 120°C).

This method of preheating cloth to a certain point prior to its entry into the metal bath is not limited to dyeing processes, but may be applied to any textile developing process, such as bleaching, scouring or the processing of nonwoven fabrics.

The apparatus illustrated in the present patent is identical with that shown in the digest of Brit P 665,454.

### DYEING NYLON——
### Hypochlorite Pretreatment C, 4, 07

Brit P 682,975
(British Nylon Spinners Ltd—Nov 17, 1952)

An aqueous pretreatment of nylon fabrics with hypochlorite solutions modifies the dyeing properties of these fibers as disclosed in the current patent.

Although Brit P 539,566 (see references below) refers to the subjecting of nylon to acid or basic solutions of chlorine-containing compounds in order to increase the affinity to dyestuffs in general, no special dye brands or classes are mentioned.

The modifying action of hypochlorite, described in the present specification, is twofold. In the case of basic dyes the hypochlorite treatment increases the depth of shade while in contrast, other dyestuff groups (acid, water-soluble acetate dyes, premetallized and chrome dyestuffs) show an inverse effect, the shade becoming more pale than that of an untreated sample. Thus the method may be used to bring about two-tone effects using treated and untreated filaments or in printing resists comprising hypochlorite printing pastes.

*Example:* A nylon fabric immersed for about 16 hours at room temperature in an aqueous solution of hypochlorite and buffered with borax is rinsed in running water, soaked in a 1% bisulfite solution, rinsed again and dried. It is then dyed in a bath containing Naphthalene Scarlet 4RS and formic acid. A shade weaker than that of a parallel dyeing on untreated material is obtained.

*References:*

Brit P 539,566, quoted in the present patent and apparently parallel to USPat 2,260,367 (Mathieson Alkali Wks—Dubeau et al—1939), describes a nylon treatment with (preferably) acid chlorite solutions to prevent discoloration and to effect more uniform penetration. This patent does not disclose the results obtained when chlorite-pretreated fabrics are dyed with different classes to obtain two-tone effects.

Articles in Du Pont's *Technical Bulletin* indicate quite generally that "bleaches of the ordinary type," i e, hypochlorite solutions, do not bleach nylon, but rather weaken the substance. It is surprising therefore to learn that uniform two-tone effects can be brought about by the hypochlorite treatment.

Further reference is made to different resists ("immunizing") in nylon dyeing. USPat 2,533,100 (Sandoz)—see *Am Dyestuff Reptr 40,* 280 (1951)—describes the action of sulfurized phenols ("Thiotans"). The same digest mentions Brit P 552,015/1943 (Courtaulds) suggesting the use of amino naphthol disulfonic acids for the same purpose.

# INDEX TO PATENT DIGEST

FOLLOWING in an index, by subject and patent number, of the patent abstracts that have appeared on these pages from July, 1952 to June, 1953, inclusive. The number in parentheses, following the page number, refers to the year in which the abstract appears.

## SUBJECT INDEX


AGER for Developing Vat Dyes in Two Separate Chambers (Swiss P 276,696) ..... 747 (1952)
CHINTZ-Polymerizable Resins Applied in Thin Layers, Preferably by Printing (U S Pat 2,598,264) ..... 17 (1953)
COLORED OIL-IN-WATER EMULSIONS——Pigments and Resins in Outer Phase (U S Pat 2,601,661) ..... 51 (1953)
CREASEPROOFING——Glucose Ureides plus Formaldehyde (U S Pat 2,596,258) ..... 769 (1952)
DYEING CELLULOSE ACETATE by Acid Vat Padding, Drying and Reducing Again (U S Pat 2,598,786) ..... 19 (1953)
DYEING CELLULOSE ACETATE with Indigosols——Urea Added (U S Pat 2,614,023) [see *Am Dyestuff Reptr* 40; 68 (1951)] ..... 231 (1953)
DYEING——Development through Liquid Metal Alloys (Brit P 665,414) ..... 442 (1952)
DYEING FLUORESCENT ARTIFICIAL FILAMENTS——Inorganic Pigments Incorporated (Brit P 669,028 ... 444 (1952)
DYEING FUR SKINS——Metallized Azodyes in Solvent Solution (U S Pat 2,585,610) ..... 416 (1952)
DYEING OR PRINTING LAKES of Basic Dyes and Phosphotungstic or Phosphomolybdic acid (U S Pat 2,589,953) .. 416 (1952)
DYEING SUPERPOLYMER FIBERS Condensed with Amino Acid Carboanhydrides (U S Pat 2,592,473) ..... 525 (1952)
DYEING WITH AZODYES Obtained by Internal Coupling Reaction (Brit P 666,462) ..... 443 (1952)
DYEING WITH CONCENTRATED VAT ACID PASTES (U S Pat 2,590,213) ..... 506 (1952)
DYEING WITH INSOLUBLE AZODYES——Stabilizing Naphtholsolutions with Polyamine Condensates (Brit P 671,979) ..... 747 (1952)
DYEING WOOL——Combinations of Dyes, Dyeing under Acid and Neutral Conditions (U S Pat 2,610,103) ..... 230 (1953)
DYEING WOOL WITH CHROMATABLE ACID DYES——Nonionic Compounds plus Magnesium Salts Used (Brit P 668,598) ..... 443 (1952)
DYEING WOOL WITH CHROMATABLE DYES——Diammonium Phosphate and Ammonium Sulfate Added (U S Pat 2,593,850) ..... 626 (1952)
DYEING WOOL WITH HIGH AFFINITY COLLOIDAL DYES——Diammonium Phosphate Used (U S Pat 2,590,847) ..... 507 (1952)
DYEING WOOL WITH METALLIZED AZODYES——Treatment with Aldehydes having Affinity for Wool (U S Pat 2,602,722) ..... 92 (1953)
DYEING WOOL WITH SULPHUR DYES——Ethanolamines Reacted with Dihydrogen-sulfide (Brit P 669,002) ... 444 (1952)
EMBOSSING CELLULOSIC RESIN IMPREGNATED TEXTILES (U S Pat 2,593,207) ..... 626 (1952)
FINISHING NYLON——Durable Coatings with Polyvinylchloride (U S Pat 2,606,845) ..... 50 (1953)
FINISHING TEXTILES——Nylon Substance Precipitated on Textiles (U S Pat 2,610,927) ..... 230 (1953)
FINISHING WOOL FABRICS——Combined Heat and Freezing Treatment (Brit P 678,585) ..... 296 (1953)
FLAMEPROOFING——Afterglow Avoided by Using Polyphosphoryl Amides (U S Pat 2,596,535-539) ..... 769 (1952)
FLAMEPROOFING——Melamine-Phosphorus Pentoxide to Prevent Afterglow (U S Pat 2,603,614) ..... 214 (1953)
FLAMEPROOFING TEXTILES——Concentrated Titanium-Antimony Solutions (U S Pat 2,607,729) ..... 214 (1953)
FLUORESCENT DYED FABRICS——Using Dyes in Dilute Alcoholic Solutions (U S Pat 2,606,809) ..... 213 (1953)
HEAT SETTING MACHINE for Synthetic Fabrics (U S Pat 2,599,486) ..... 49 (1953)
INDIGOSOL DYEINGS ON ANIMAL FIBERS—Urea in Acid Solutions (U S Pat 2,618,259) ..... 394 (1953)
INGRAIN (Fleck) Effects Produced in Wool Dyeing (Brit P 680,862) ..... 296 (1953)
NONWOVEN CELLULOSIC FABRICS treated with resin colloids (U S Pat 2,617,744) ..... 394 (1953)
NYLON-QUINONE TREATMENT for Increasing Heat Resistance (U S Pat 2,597,163) ..... 48 (1953)
ONIUM DYESTUFFS——Printing Methods (U S Pat 2,599,371) ..... 48 (1953)
PARCHMENTIZED PRINTS——Pigmented Parts Remaining Soft (U S Pat 2,611,678) ..... 264 (1953)
PERMANENT FINISH——Maleic Anhydride-Vinyl Resins and Polyalcohols (U S Pat 2,609,350) ..... 263 (1953)
PIGMENT DYEING——Resin Pretreatment (U S Pat 2,596,192) ..... 746 (1952)
POLYAZODYES——Aliphatic Amines and Copper Complex Compounds Added (U S Pat 2,594,803) ..... 627 (1952)
PRINTING ACETATE OF CELLULOSE——Condensates of Ricinoleic Acid and Ethylene Oxide (Brit P 664,646) ... 435 (1952)
PRINTING DIRECT OR ACID DYES——Fixation with Cyanamide-Formaldehyde (Brit P 668,421) ..... 435 (1952)
PRINTING TEXTILES——Colored Patterns Transferred from Printed Paper Sheets (U S Pat 2,583,286) ..... 415 (1952)
PRINTING VAT DYES Fast Brown Shades (Brit P 671,382) ..296 (1953)
PRINTING VAT DYES——Thickened with Oil-in-Water Emulsions (U S Pat 2,597,281) ..... 770 (1952)
PRINTING VAT DYES——Thickened with Water-in-oil Emulsions (U S Pat 2,594,899) ..... 627 (1952)
SCREEN PRINTING BACK GREIGE BLANKET (U S P 2,590,643) ..... 508 (1952)
SHRINKPROOFING WOOL——Acid Colloidal Solutions of Melamine Resins (U S Pat 2,609,307) ..... 215 (1953)
SHRINKPROOFING WOOL——Chloramides and Chlorosulfonamides Used (U S Pat 2,590,390) ..... 507 (1952)
SHRINKPROOFING WOOL——Permanganate Treatment at Elevated Temperature under Pressure (U S Pat 2,548,774) ..... 415 (1952)
SHRINKPROOFING WOOL——Polymers of Glycidyl Esters of Unsaturated Acids (U S Pat 2,606,810) ..... 213 (1953)
SHRINKPROOFING WOOL WITH PEROXIDE——Metal Salt Pretreatment (U S Pat 2,599,977) ..... 18 (1953)
SHRINKPROOFING WOOLEN GARMENTS——Dry Chlorination under Controlled Moisture Conditions (U S Pat 2,590,811) ..... 506 (1952)
STABILIZING CELLULOSIC FABRICS——Dimethylhydantoin Formaldehyde Condensates (U S Pat 2,602,017/8) 50 (1953)
STABILIZING REGENERATED CELLULOSE——Two-Step Treatment (U S Pat 2,608,494) ..... 215 (1953)
STATIC PREVENTION——Vinyl Polymers Treated with High Alkylsulfates of Guanidine (U S Pat 2,597,708) .... 17 (1953)
VAT DYEING ACRYLONITRILE POLYMERS——Ionizable Potassium Compounds Used (U S Pat 2,598,120) ..... 770 (1952)
VAT DYEING with Cobaltphthalocyanines (U S Pat 2,613,128) 264 (1953)
VAT DYEING with Cobaltphtholocyanines——Phosphonous Acid Compounds (U S Pat 2,613,129) ..... 264 (1953)
WATER REPELLENT ANIMAL FIBERS——Dilute Soap and Aluminum Salt Solutions (U S Pat 2,599,590) ..... 19 (1953)
WATER-REPELLENT FABRICS——Urea-Glyoxal-Formaldehyde-Condensates Condensed with Higher Fatty Alcohols (U S Pat 2,588,640) ..... 506 (1952)
WATER REPELLENT FINISHES——Organosilicon Compounds Combined with Amino Resins (U S Pat 2,612,482) 231 (1953)
WATER-REPELLENT TEXTILES Treated with Silicone-Oil Emulsions (U S Pat 2,597,614) ..... 18 (1953)


## PATENT INDEX


U S Pat 2,618,259 (Gen Dyestuff Corp) ..... 394 (1953)
U S Pat 2,617,744 (Am Cyanamid) ..... 394 (1953)
U S Pat 2,614,023 (Celanese Corp)
(see Brit P 641,835) ..... 231 (1953)
U S Pat 2,613,129 (Du Pont) ..... 264 (1953)
U S Pat 2,613,128 (Farbenfabr Bayer) ..... 264 (1953)
U S Pat 2,612,482 (Gen Electric Co) ..... 231 (1953)
U S Pat 2,611,701 (Gen Aniline & Film)
see *Am Dyestuff Reptr* 41 ..... 152 (1952)
U S Pat 2,611,678 (Ginzel) ..... 264 (1953)
U S Pat 2,610,927 (Tootal Broadhurst Lee Co) ..... 230 (1953)
U S Pat 2,610,103 (Ciba Ltd) ..... 230 (1953)
U S Pat 2,609,350 (Gen Aniline) ..... 263 (1953)
U S Pat 2,609,307 (Am Cyanamid) ..... 215 (1953)
U S Pat 2,608,494 (Walkden, Making & Co) ..... 215 (1953)
U S Pat 2,607,729 (Du Pont) ..... 214 (1953)
U S Pat 2,606,845 (Du Pont) ..... 50 (1953)
U S Pat 2,606,810 (Am Cyanamid) ..... 213 (1953)
U S Pat 2,606,809 (Switzer-Ward) ..... 213 (1953)
U S Pat (2,603,614 (Monsanto Chem Co) ..... 214 (1953)
U S Pat 2,602,722 (Ciba Ltd) ..... 92 (1953)
U S Pat 2,602,017/8 (Beer) ..... 50 (1953)
U S Pat 2,601,661 (Am Cyanamid) ..... 51 (1953)
U S Pat 2,599,977 (Brit Wool & Cotton Dyers) ..... 18 (1953)
U S Pat 2,599,590 (Harris Res Labs) ..... 19 (1953)
U S Pat 2,599,486 (Werner Machine Co) ..... 49 (1953)
U S Pat 2,599,371 (Imp Chem Ind) ..... 48 (1953)
U S Pat 2,598,786 (Celanese Corp) ..... 19 (1953)
U S Pat 2,598,264 (Jos Bancroft & Sons) ..... 17 (1953)
U S Pat 2,598,120 (Du Pont) ..... 770 (1952)
U S Pat 2,597,708 (Am Cyanamid) ..... 17 (1953)
U S Pat 2,597,614 (Harris Res Labs) ..... 18 (1953)
U S Pat 2,597,281 (Am Cyanamid) ..... 770 (1952)
U S Pat 2,597,163 (Michaels-Machlis) ..... 48 (1953)
U S Pat 2,596,258 (Meijer) ..... 769 (1952)
U S Pat 2,596,192 (Dan River Mills) ..... 746 (1952)
U S Pat 2,595,535-539 (Monsanto) ..... 769 (1952)
U S Pat 2,594,899 (Am Cyanamid) ..... 627 (1952)
U S Pat 2,594,803 (Ciba Ltd) ..... 627 (1952)
U S Pat 2,593,850 (Victor Chem Works) ..... 626 (1952)
U S Pat 2,593,207 (Betex Sales Corp) ..... 626 (1952)
U S Pat 2,592,852 (Jos Bancroft & Sons) ..... 508 (1952)
U S Pat 2,592,473 (Du Pont) ..... 525 (1952)
U S Pat 2,590,847 (Pacific Mills) ..... 507 (1952)
U S Pat 2,590,811 (Forstmann Woolen Co) ..... 506 (1952)
U S Pat 2,590,643 (Owren-Koralczuk) ..... 508 (1952)
U S Pat 2,590,390 (Wolsey Ltd) ..... 507 (1952)
U S Pat 2,590,213 (Sandor) ..... 506 (1952)
U S Pat 2,589,953 (Calico Printers' Assn) ..... 416 (1952)
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U S Pat 2,585,610 (Ciba Ltd) ..... 416 (1952)
U S Pat 2,583,286 (Albini-Colombo) ..... 415 (1952)
U S Pat 2,548,774 (Coe, Jr.) ..... 415 (1952)
Brit P 680,862 (Fosse Dyeworks Ltd) ..... 296 (1953)
Brit P 678,585 (Kostring) ..... 296 (1953)
Brit P 671,979 (Danner-Zerweck) ..... 747 (1952)
Brit P 671,382 (Imp Chem Ind) ..... 296 (1953)
Brit P 670,522 (Ciba Ltd)
see U S Pat 2,594,803
Brit P 669,028 (Brit Celanese Ltd) ..... 444 (1952)
Brit P 669,002 (Ver Farbereien Akt Ges) ..... 444 (1952)
Brit P 668,598 (Farbenfabriken Bayer) ..... 443 (1952)
Brit P 668,421 (Courtaulds Ltd) ..... 435 (1952)
Brit P 666,462 (Anderson) ..... 443 (1952)
Brit P 665,454 (Standfast Dryers & Printers) ..... 442 (1952)
Brit P 664,646 (Imp Chem Ind) ..... 435 (1952)
Swiss Pat 276,696 (Benz) ..... 747 (1952)

# NEWS

## • Berkshire Color & Chemical Purchases Perkins Soap Co

Berkshire Color & Chemical Corporation, Springfield, Mass, through its president, Floyd F Warshaw, has announced acquisition of the plant and equipment of the Perkins Soap Company, also of Springfield.

All manufacturing and research facilities as well as general sales offices are now located at 210 Albany St, Springfield, Mass.

Effective immediately, Perkins Soap Company will be operated as a division of Berkshire Color & Chemical Corp. It will continue to manufacture and distribute all the principal products produced for the past thirty years for the textile, paper, tanning and metal industries.

Berkshire distributes exclusively throughout New England the "Durofast" colors and other dyestuffs manufactured by the Berkshire Color & Chemical Mfg Corp of Delawanna, N J.

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## • Central Yarn and Dyeing Adds to Package Dyeing Facilities

Eight additional winders for dye tube preparation have been installed by Central Yarn and Deying Company, Gastonia, N C. The new winders, installed to handle increased demand for spun synthetics, will enable processing of spun synthetic yarns to be kept separate from processing of filament yarns.

The installation rounds out production facilities for package dyeing of all types of synthetic yarns, according to Herbert Girard, Central Yarn's director of research and development.

The new winders are an addition to the quarter-million dollar expansion program completed recently "to meet the demand for package dyeing of synthetic yarns according to Central Yarn's own high temperature, high-pressure method," Mr Girard stated.

The firm has been package dyeing production quantities of spun and filament yarns of nylon, Orlon and Dacron, in wide color ranges, for suitings, full-fashioned hosiery, woven and knitted fabrics, underwear, neckwear and men's hose.

## • Witco Accident Rate Cut 60 Per Cent

Results of a new safety program, started July, 1952, at the Witco Chemical Company's Chicago plant, show that accidents have been reduced by 60 per cent. The record of no lost time accidents since October, 1952, has raised the plant from an average safety bracket to well above average.

The program revolves around the work of a management-employee safety committee which meets once a month to discuss precautionary measures, new ideas, follow-ups on previous recommendations and methods for making employees alert to accident prevention.

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## • Bjorksten Chicago Offices Moved

Bjorksten Research Laboratories, Inc have moved the Chicago office and laboratories from their previous location at 13791 South Avenue "O" to 1525 East 53 Street, Chicago 15. Edwin L Gustus, Vice President, will continue to head this branch.

Bjorksten Research Laboratories maintains its headquarters in Madison, Wisconsin, where a new three-story laboratory and office building is currently in construction.

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### NOTE

Attention is called to page 229 (issue of April 13). In the article "The Physical Action of Surface-Active Agents in the Mechanism of Detergency," by Henri L Rosano and Marianne Weill, the following should be noted:

(1) The paragraph beginning with *"Cationic detergent (cetyl pyridinium chloride):"* should read "As the plate is tilted, there is no floating of the drop over a film of the solution. The contact angle is sharp and the forepart of the drop moves while the remainder sticks to the solid (Fig 6). These remarks are in agreement with the considerations of Goette (6) regarding the electric charge of the dirt globules. In fact, we see here a redeposition of the emulsified dirt droplets."

(2) The first paragraph of the second column ends with the words "hydrophobic solid." This should read "hydrophilic solid."

## • Interchem Establishes Commercial Research Dept

Interchemical Corporation, New York, N Y, has announced the establishment of a commercial research department, which will consolidate activities carried on informally in the past by other departments and will be staffed by a group with broad experience in Interchemical problems.

The activities of the new department will be:

1) Investigating the commercial possibilities of additional products or new ideas which offer opportunities for diversification and expansion.
2) Implementing the disposition of products or developments which appear to have merit but which do not appear suitable or attractive for exploitation by Interchemical.
3) Carrying forward the development of new products or projects until they may be assigned to operating divisions.

Zeno Wicks, former member of the Interchemical Research Laboratories, is manager of the new department, reporting to Norman Cassel, Interchemical vice president concerned with research and development. His associates are Henry Young and John Duane, with Milton Zucker serving as active consultant.

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## • Marshall & Williams Sales Corporation Distributing in South

With the formation of the new Marshall & Williams Sales Corporation of Greenville, S C, under the direction of Fred H Land, president and treasurer, textile finishing plants in eleven Southern states are afforded service and distribution facilities for the entire line of finishing equipment produced by James Hunter Machine Co for cotton and synthetic fabrics, in addition to the standard line of Marshall and Williams products.

Products to be supplied by the new organization include the Hunter Vapojet Dryer; the Anco Rotary Joint; M & W high-speed tenter frames, batchers, let-off stands, swing plaiters, and a complete line of tenter clips. (Exclusive U S and Canadian rights to make and sell the new universal tenter clip recently developed by James Hunter Machine Co, as well as to build the clip for use with all Hunter overfeed equipment, have been assigned to Marshall & Williams). Also available will be M & W tenterettes, an M & W exclusive.

## • Rayon Information Center

As the first step in establishing an industry-wide rayon information and service program for consumers, retailers, mills and manufacturers, a Rayon Information Center was recently established at 670 Fifth Avenue, New York, N Y.

The new program reportedly has an initial appropriation of $750,000 and may be increased substantially as the program develops.

As background for the establishment of the Center, it was pointed out that rayon, the first commercially successful man-made fiber, has virtually doubled production during each five year period since 1925 and now ranks second in poundage utilized among all textile fibers. It was pointed out, further, that the industry's research is continuing to improve the product, develop new uses and expand the market.

At the retail level, it was stressed, rayon now accounts for "an impressive share of sales dollars in items ranging from sheerest fabrics to heavy duty tires."

Objectives of the Rayon Information Center were defined as follows:

1) To provide service and information to consumers on how to get maximum utility out of rayon garments and fabrics.
2) To develop merchandising opportunities for retailers through special projects, informational assistance, sales aids and sales training.
3) To work with mills, converters, dyers and finishers, cutters, designers and others to make the most of rayon's inherent qualities and to encourage new styles, constructions and fabric developments.

Members of an industry task force committee responsible for planning and developing the new program are: E F Altmaier, manager, advertising and promotion, Textile Fibers Department, E I du Pont de Nemours & Co, Inc; James C Fortune, advertising manager, American Bemberg and North American Rayon Corporation; John K Hanson, manager, advertising and promotion, American Enka Corporation; Charles W Rice, Jr, advertising manager, American Viscose Corporation; and Alvin A Schoenberger, sales manager, Cloth Division, Industrial Rayon Corporation.

Eldean-Bugli-Chesrown, Inc, business development organization, has been retained to operate the new Rayon Information Center.

## • 300 Attend NBTI Alumni Homecoming

The annual homecoming weekend of the New Bedford Textile Institute Alumni Association, held in New Bedford, Mass, June 5 and 6, attracted approximately 300 alumni wives and friends.

The opening event was the annual golf tournament at the New Bedford County Club with Ferdinand Fiocchi of the NBTI faculty turning in the best score.

At the business meeting held on Saturday morning in Kelleher House, the following officers were elected:

*President*—Roger Gentilhomme.
*Vice President*—William Poisson.
*Secretary*—James Giblin.
*Treasurer*—Francis Tripp.
*Directors (for 3 years)*—Adam Bayreuther, Edward Lafferty, Henry Taylor.

Administrative plans for future improvements in carricula and physical plant at NBTI were outlined to the alumni by Dean Augustus Silva.

The homecoming was concluded on Saturday afternoon at Dan's Pavilion with the New England clambake, presentation of golf prizes, introduction of the new alumni, and entertainment.

# NEW PRODUCTS AND DEVELOPMENTS

## • Dynel Windsor Felt

Dynel Windsor Felt, a chemically resistant, fiber-bonded filter fabric developed by the American Felt Company's Engineering and Research Division, Glenville, Conn, was introduced by the company on June 1st.

The new dynel material was developed as a filter mat for use in filter press or vacuum filter applications for efficient cake formation or clarity of filtrate.

Dynel Windsor Felt is constructed with multi-ply carded construction for a highly uniform fiber distribution. The new material is the latest addition to the range of fiber-bonded Windsor Felts which were pioneered in 1937 by the American Felt Company.

Engineering and Research Division data as to chemical and physical properties of Dynel Filter Felt have been issued to identify the characteristics of the new material.

The construction of the product is said to create a highly efficient filter medium or cake supporting mat for collection of small particles. It is reported stable to bacteria, such as mold or fungi, and is said to exhibit excellent resistance to acid or alkaline solutions. Dynel Windsor Felt, a sturdy fabric which can be handled like any industrial fabric, wets out readily and shows good cake release, it is stated.

## • Progress Toward Experimental Barotor

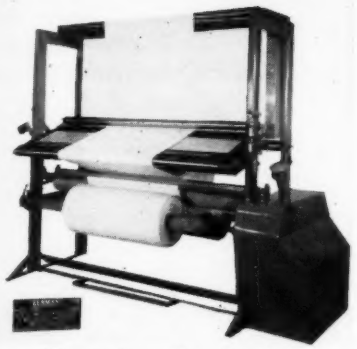
Research is progressing toward a simplified and improved experimental model of the Barotor, a pressurized fabric dyeing machine developed in the Textile Research Laboratory of E I Du Pont de Nemours & Co, Inc, according to William L Hyden, director of the Textile Research Division. The new experimental model is the result of intensive development and full commercial scale dyeing trials since the original Baroter model was introduced in August, 1952.

In these dyeings, filament fabrics of Orlon acrylic fiber, Dacron polyester fiber, nylon, and acetate, up to 65 inches wide, have been dyed in open width with good levelness while batches up to 1000 yards of a four-ounce taffeta of Dacron filament have been dyed successfully, according to Dr Hyden. Staple fabrics of Orlon and Dacron also have been dyed satisfactorily in the Barotor. Research is now in progress on determining the ultimate capacity of the machine.

Complete dyeing cycles of less than five hours, including time for loading and unloading, have been demonstrated with commercial size batches. Samples of the dyed fabric can be taken from the new model of the Barotor at any time during the dyeing cycle without interrupting operation, it is claimed.

The Barotor was developed to capitalize on the advantages of batch-dyeing fabrics above the boil (212°F) and at pressures above atmospheric pressure. Since the original model was introduced ten months ago, extensive operating experience with large yardages has resulted in a simplification of the machine. The dropping bars of the original model have been replaced by fixed bars. In addition, the number of bars has been reduced to less than 20 per cent of the number needed to dye a 1000-yard batch in the former model of the Barotor. The reduction has, in turn, eliminated the need for expensive automatic loading and unloading equipment that was formerly thought necessary. A simplified semi-automatic loading and unloading arrangement has been satisfactorily operated, Dr Hyden said.

Dr Hyden has pointed out that inquiries on prices and orders are being accepted by the following manufacturers with whom licenses to make the Barotor are being negotiated under pending patents: James Hunter Machine Co, Wiesner-Rapp Co, Inc, Rodney Hunt Machine Co, and Riggs & Lombard, Inc. In due course, it is thought that similar licensing arrangements will be made with interested foreign machine manufacturers.



Hermas Inspecting Machine

## • Heavy Duty Machine for Inspecting, Winding, Measuring

Especially designed for handling large rolls of cloth more efficiently, a new type of inspecting machine currently being manufactured by Hermas Machine Co, Hawthorne, N J, has been sturdily designed throughout.

The frame is of 5" channel steel, to take the weight of 36" rolls of cloth without vibration. All other structural parts are reported to be of equally rugged construction.

For greater flexibility in operation, there is a variable speed drive with a 9 to 1 ratio. For those who need them, a vertical light box or through-lighting in the inspecting table are available.

A reverse wind and automatic over-run prevention-brake on the let off are standard equipment.

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## • Hartopon—Conc

The Hart Products Corp, New York, is currently marketing "Hartopon-Conc," a highly concentrated member of the new Hartopon series of detergents now being offered. The product is a cream-white colored paste, which is said to display excellent detergency, wetting and sudsing action. Chemically, it is classified as a fatty sulfate of approximately 40% active content.

Hartopon Conc is recommended by the manufacturer for use in most textile cleaning operations, such as the scouring of cotton, rayon, acetate, wool, silk, nylon, Orlon and Dacron. It is pointed out that Hartopon Conc is stable in the presence of reducing and oxidizing agents, reduces the harshening effect of vigorous scouring procedures and possesses outstanding protective action and dispersing powers.

Hartopon Conc, as outlined by Hart Products, is effective in very low concentration because of its high activity. It is said to display thorough cleaning, rapid and complete rinsing in hard or soft water and to be exceptionally low in cost.

## • "THPC" Used in Development of Improved Flameproofed Cotton Fabrics

A recent announcement by the United States Department of Agriculture discloses that its chemical research has developed improved flameproofed cotton fabrics, using a chemical known as "THPC", or tetrakis (hydroxymethyl) phosphonium chloride.

THPC applied to cotton fabrics by conventional methods of processing is said to have given these fabrics excellent flameproofing qualities, in research at the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory in New Orleans. Cloth treated by the THPC process should be useful for curtains, draperies, upholstery, bedding, and other household items. Wilson A Reeves and John D Guthrie of the Laboratory's Cotton Chemical Processing Division developed the new process.

The chemically-treated fabrics reportedly retain flameproofness after more than 15 launderings. Two additional advantages of the new fabrics are good wrinkle resistance and absence of afterglow.

G E Hilbert, Bureau Chief, has stated that the "THPC process" is one of several flameproofing treatments being investigated in cooperative work with the Army Quartermaster Corps to develop a flameproof fabric suitable for military clothing. Two of these chemical processes are described in the Bureau's annual report for 1952.

The new flameproofing finish is applied on standard textile equipment in a process similar to that used in creaseproofing cloth by commercial methods. The fabric is treated with solution, dried for a few minutes at a temperature of 285° F, and washed to remove unused chemicals.

Chemicals used in the process include THPC, urea, and methylomelamine. The process should cost only slightly more than some of the less permanent flameproofing processes now in commercial use, according to Dr Hilbert.

Information on flameproofing investigations and small samples of fabric treated by the THPC process may be obtained by writing to Dr C H Fisher, Director, Southern Regional Research Laboratory, New Orleans, La.

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## • N-Phenylmaleamic Acid

N-Phenylmaleamic Acid, a yellow crystalline material now available in trial-lot quantities from American Cyanamid Company, is showing promise for use in the preparation of resins for synthetic fibers and plastics and as an intermediate for synthesis of new products.

In laboratory experiments to date, the following chemical reactions have been reported: formation of water-soluble alkali metal salts; Michael condensations; copolymerization with acrylonitrile, ethyl acrylate, vinyl acetate and other monomers; Diels-Alder reaction; dehydration to N-Phenylmaleimide.

A technical bulletin on the chemical may be obtained from Cyanamid's New Product Development Department, 30 Rockefeller Plaza, New York 20, N Y.

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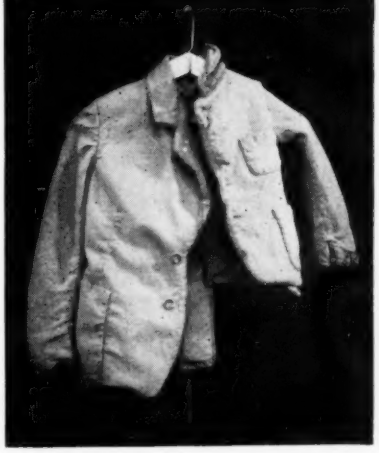
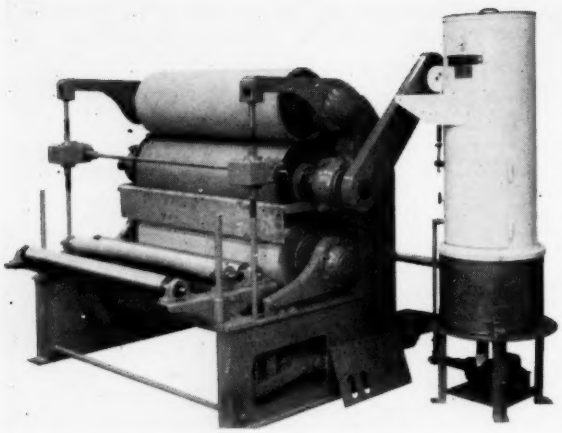
## • DeCetex 104 Emulsion; Wool Stabilizing Finish

Dow Corning Corporation, Midland, Michigan, announces that DeCetex 104, silicone water repellent finish for textiles, is now available as DeCetex 104 Emulsion, a stable, water-dilutable product. It is stated that fabrics properly treated retain unusually high spray ratings after laundering or dry cleaning, exhibit a high order of stain resistance, possess a very desirable hand, and show increased abrasion resistance, greater tear strength, reduced mark-off and improved sewability. The finish is colorless and does not alter the appearance of the fabric. If DeCetex 104 Emulsion is properly mixed with crease resistant resins, both can be applied at the same time to impart water repellency and crease resistance in one operation. DeCetex 104 Emulsion is supplied with Dow Corning Catalyst XEY-16 in the form of an emulsion which is readily miscible.

Another new development at Dow Corning is a wool stabilizing finish, also a silicone product. After the left half of a sports jacket was treated with the product and the other half left untreated, the garment was given the following wash test: 1 hour at 140°F in a rotary wheel washer, followed by 5 minutes extraction and 30 minutes in a tumbler dryer at 135°F. There was practically no shrinkage of the treated half of the jacket as shown in the photo.





**Cook-P&N 3-Roll Lever-Set Padder**

## • Cook-P&N Lever-Set Padder

Cook-P&N Machine Co, Boston 27, Mass, has developed a new lever set padder with a middle roll drive for 10 ton pressure and a worm and wheel elevating mechanism. The principal of driving the middle roll is said to eliminate slippage at the nip and also to assure equal pressure at both nips. All fulcrum points are equipped with Cook knife-edge pivot pins, designed to eliminate unequal pressure.

## • New Du Pont Dyes

The production of six new dyes, designated Leucosol Yellow LN Paste, Latyl Violet B, Latyl Orange R, Latyl Red B, Latyl Brilliant Blue 2G and Latyl Blue GE, were announced during May and June by the Du Pont Company's Dyes and Chemicals Division.

The dyes of the "Latyl" group were specifically developed for application to Dacron polyester fiber, but can also be used for pastel shades on acetate. Leucosol Yellow LN Paste is said to produce bright greenish-yellow shades on cotton of superior light fastness.

Du Pont offers the following descriptive material:

"Leucosol Yellow LN Paste, an anthraquinone vat color, is recommended for application in light to heavy shades and especially in formulating chartreuse, green, and brown shades. Since its light fastness is maintained when the color is combined with other fast-to-light vat dyes, it should find uses in printing drapery, upholstery, and dress goods fabrics. It is also suitable for printing rayon as well as for the printing of fabrics that are to be resin treated. It is easily combined with gums and starches to form a printing paste of good viscosity that flows freely in the machine.

"Latyl Violet B, a new dispersed type dye, has a bright blue-violet shade on both filament and spun Dacron and does not tar in the dyebath. It is an excellent base for brown, navy, and black shades and is recommended for application to stock, top, tow, or fabric forms of Dacron. It can be applied at normal dyeing temperatures with carriers, at elevated temperatures without carriers, and by the Thermosol process.

"Latyl Orange R is characterized by its bright, reddish-orange shade. It is applied from aqueous carrier baths, from aqueous pressure baths without a carrier, or by the Thermosol process. In pastel shades the color is extremely fast to light and shows very good resistance to wet-processing treatments. Latyl Orange R is level dyeing and is recommended for use with Latyl Brilliant Blue 2G in the production of level-dyed, light-fast grays and tans. On acetate, particularly in the pastel range, Latyl Orange R possesses good light, washing, and gas-fume fastness. The color builds up well up to 1.0 per cent on acetate but at higher concentrations a redder shade with no increase in strength is obtained. It has good light fastness on Orlon acrylic fiber, excellent light fastness on Saran, but is poor in this respect on nylon. The color is suitable for printing acetate in the lighter shades. Union dyeing 50/50 mixtures of Dacron and wool shows wool to be considerably stained by Latyl Orange R, but not to an extent where wool fastness is impaired.

"Latyl Red B has very good wet fastness properties. It can be used advantageously in light shades of gray and tan because of its outstanding light fastness. Under artificial light, Latyl Red B appears more yellow, which may counteract the redness of blues and violets used in the formulation of certain mixtures. The color builds up well in medium full shades and dyes levelly when applied from either aqueous carrier baths or when pressure dyed without a carrier. When using benzoic acid or orthophenylphenol as dyeing assistants, it is suggested that they be removed from the material by scouring with an alkali and Duponol D Paste fatty alcohol sulfate. Latyl Red B is also of interest for use on acetate since it possesses very good light fastness in the lighter shade. Heavy shades are not recommended on this fiber because the color does not build up sufficiently.

"Latyl Brilliant Blue 2G produces extremely bright, greenish-blue shades of special interest for pastels and is a suitable blue component in formulating bright greens, grays, tans, and browns because of its satisfactory build-up. Outstanding light fastness is one of the principal characteristics of this color, which also has very good wet fastness properties from all application methods. Latyl Brilliant Blue 2G is of considerable interest on acetate in pastel shades because of its remarkably good fastness to gas-fume fading and light. When dyeing mixed fibers composed of Dacron and wool, this new dye leaves the wool considerably stained but not enough to reduce wool fastness.

"Latyl Blue GE has very good light and wet fastness and is of interest for use in combinations. It is recommended as the blue component in mixtures with Latyl Violet B and Acetamine Fast Yellow 4RL for producing navy shades that are fast to light. Latyl Blue GE can be applied to filament or spun forms of Dacron from aqueous carrier baths, by pressure dyeing without a carrier and by the Thermosol process. The light fastness of this dye is only slightly lowered by residual carrier left in the fiber. Medium shades of Latyl Blue GE on 50/50 blends of Dacron and wool produce a definite stain on wool; however, the staining does not have a serious effect on wool fastness in light shades."

## • New GAF Products Available

New products developed during the last quarter by General Aniline & Film Corporation and recently made available, include:

*In tank-car quantities:* Butyrolactone; 2-Pyrrolidone; and the ammonium salt of the half amide of PVM/MA;

*In drum lots:* N-Vinyl-2-pyrrolidone;

*In limited quantities:* 2-Butene-1,4-diol; and N-Methyl-2-pyrrolidone.

Butyrolactone, structurally the inner ester of gamma-hydroxybutyric acid, is a chemical intermediate of interest for aliphatic and cyclic compounds and has been used in a methionine synthesis and for making N-alkylpyrrolidones. It is a liquid from minus 44°C to 204°C and is of value as a general solvent, especially for acrylonitrile polymers and other high polymers, and as a selective solvent for acetylene in natural and other gases.

2-Pyrrolidone, is a five membered heterocyclic ketone of value as a chemical intermediate in reactions involving substitutions on the ring nitrogen. It is also of potential interest as a selective solvent.

The ammonium salt of the half amide of PVM/MA (methyl vinyl ether-maleic anhydride copolymer) is available as a white amorphous powder. The material, which is a neutral, water-soluble, hydrophilic colloid, has a viscous and adhesive properties that suggest its use in sealing formulations and coatings of all types. The product can also be crosslinked with formaldehyde to form insoluble compounds.

N-Vinyl-2-pyrrolidone is said to polymerize readily, giving polymers with many unusual industrial applications arising from the complexing ability and water solubility of the molecule. It is also of interest in copolymerization reactions with acrylic acid, acrylonitrile, styrene and other vinyl monomers.

2-Butene-1,4-diol, an unsaturated glycol, is a reactive intermediate which cyclizes to dihydrofuran, hydroxylates to erythritol, and forms a variety of unsaturated polyesters and alkyds. It also reacts with dibasic acids to form plasticizers and takes part in many other reactions typical of compounds with the hydroxyl groups and the carbon-carbon double bond.

N-Methyl-2-pyrrolidone, one of the latest products made available from GAF's development program on high pressure acetylene derivatives, is a selective solvent for use in gas streams. It is said to be capable of dissolving thirty-nine times its volume of acetylene at room temperature and atmospheric pressure. It is also useful as a solvent for a number of difficult-to-dissolve resins, such as acrylonitrile, ethyl cellulose, and polystyrene.

For technical information and samples write to Commercial Development Dept, General Aniline & Film Corp, 435 Hudson St, New York 14, N Y.